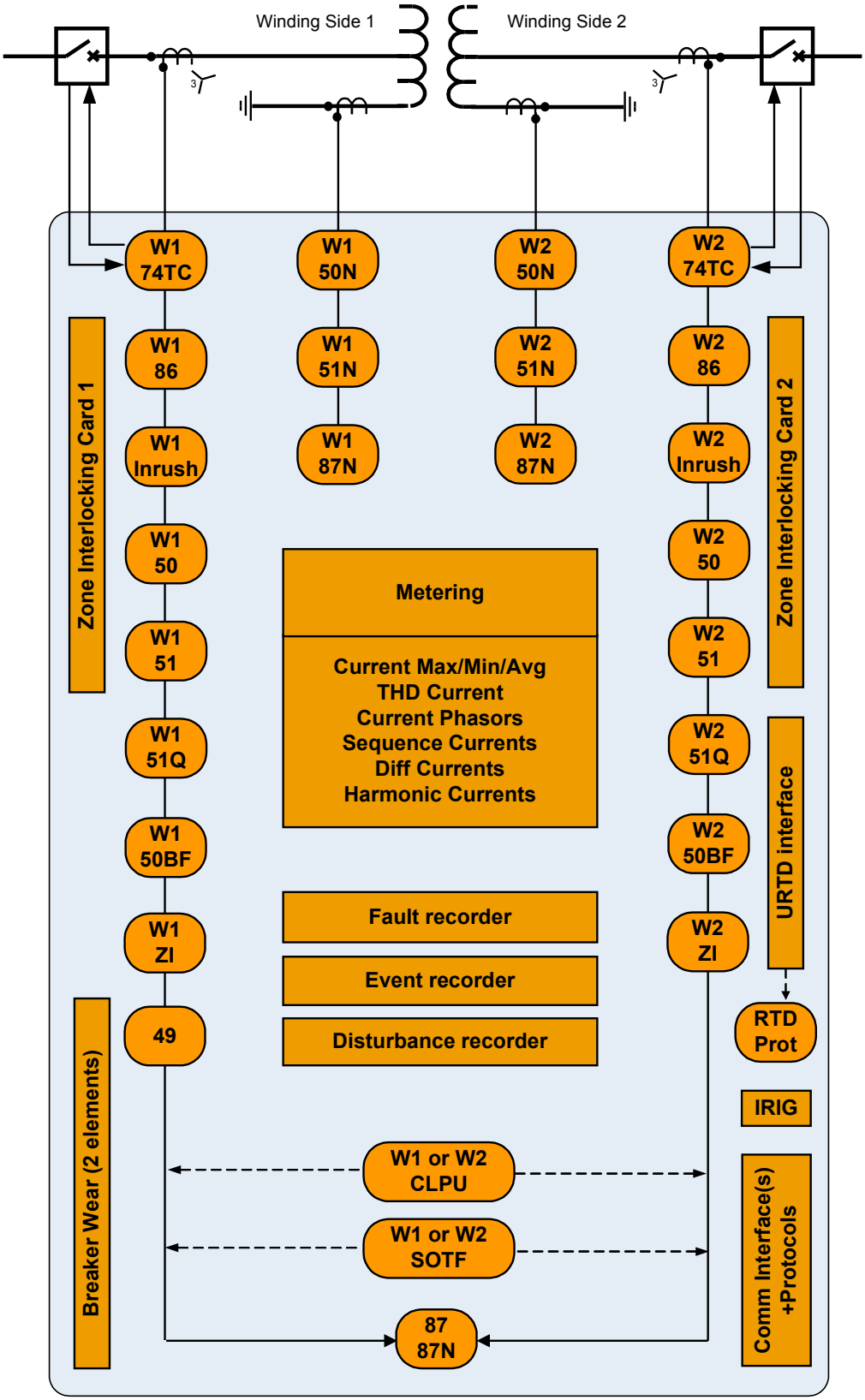
Powering Business Worldwide

IM02602004E
Rev. New

ETR-4000 EATON TRANSFORMER RELAY

Instruction manual for installing, operating and maintaining the ETR-4000

ETR-4000 Typical Configuration



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This manual applies to devices (version):

Version 1.0.h

Build: 8463, 8526

Comments on the Manual

This manual gives a general explanation of the tasks of device planning, parameter setting, installation, commissioning, operation and maintenance of the Eaton devices.

The manual serves as reference document for:

- Engineers in the protection field;
- Commissioning engineers;
- Personnel dealing with the setting, testing and maintenance of protection and control devices; and
- Well trained personnel involved in electrical installations and power stations.

All functions concerning the type code will be defined. Should there be a description of any functions, parameters or inputs/outputs that do not apply to the device in use, please ignore that information.

All details and references are explained to the best of our knowledge and are based on our experience and observations.

This manual describes the full featured versions of the devices, including all options.

All technical information and data included in this manual reflect their state at the time this document was issued. Eaton Corporation reserves the right to carry out technical modifications in line with further development without changing this manual and without previous notice. Therefore no claim can be brought based on the information and descriptions included in this manual.

Text, graphics, and formulas do not always apply to the actual delivery scope. The drawings and graphics are not true to scale. Eaton Corporation does not accept any liability for damage and operational failures caused by operating errors or disregarding the directions of this manual.

No part of this manual is allowed to be reproduced or passed on to others in any form, unless Eaton Corporation has issued advanced approval in writing.

This user manual is part of the delivery scope when purchasing the device. In case the device is passed on (sold) to a third party, the manual has to be passed on as well.

Any repair work carried out on the device requires skilled and competent personnel with verifiable knowledge and experienced with local safety regulations and have the necessary experience with working on electronic protection devices and power installations.

IMPORTANT DEFINITIONS

The symbol/word combinations detailed below are designed to call the User's attention to issues that could affect User safety and well being as well as the operating life of the device.

DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION, used with the safety alert symbol, indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

CAUTION, without the safety alert symbol, is used to address practices not related to personal injury.

NOTICE **NOTICE is used to address information and practices not related to personal injury.**

WARNING **FOLLOW INSTRUCTIONS**

Read this entire manual and all other publications pertaining to the work to be performed before installing, operating, or servicing this equipment. Practice all plant and safety instructions and precautions. Failure to follow the instructions can cause personal injury and/or property damage.

WARNING **PROPER USE**

Any unauthorized modifications to or use of this equipment outside its specified mechanical, electrical, or other operating limits may cause personal injury and/or property damage, including damage to the equipment. Any such unauthorized modifications: (1) constitute "misuse" and/or "negligence" within the meaning of the product warranty, thereby excluding warranty coverage for any resulting damage; and (2) invalidate product certifications or listings.

The programmable devices subject to this manual are designed for protection and also control of power installations and operational devices. The devices are further designed for installation in low-voltage (LV) compartments of medium voltage (MV) switchgear panels or in de-centralized protection panels. The programming and parameterization has to meet all requirements of the protection concept (of the equipment that is to be protected). You must ensure that the device will properly recognize and manage (e.g.: switch off the circuit breaker) on the basis of your programming and parameterization all operational conditions (failures). Before starting any operation and after any modification of the programming (parameterization) test make a documentary proof that your programming and parameterization meets the requirements of your protection concept.

Typical applications for this product family/device line are for example:

- **Feeder protection;**
- **Mains protection;**
- **Transformer Protection and**
- **Machine protection.**

This device is not designed for any usage beyond these applications. The manufacturer cannot be held liable for any resulting damage. The User alone bears the risk if this device is used for any application for which it was not designed. As to the appropriate use of the device: The technical data specified by Eaton Corporation have to be met.

OUT-OF-DATE PUBLICATION

This publication may have been revised or updated since this copy was produced. To verify that you have the latest revision, be sure to check the Eaton Corporation website:

www. eaton.com

The latest versions of most publications are available at this site.

If your publication is not found on the web site, please contact Eaton customer support to get the latest copy.

CAUTION

ELECTROSTATIC DISCHARGE AWARENESS

All electronic equipment is sensitive to electrostatic discharge, some components more than others. To protect these components from electrostatic damage, the User must take special precautions to minimize or eliminate electrostatic discharges.

Follow these precautions when working with or near the device.

1. **Before performing maintenance on the electronic device, discharge the static electricity on your body to ground by touching and holding a grounded metal object (pipes, cabinets, equipment, etc.).**

2. **Avoid the build-up of static electricity on your body by not wearing clothing made of synthetic materials. Wear cotton or cotton-blend materials as much as possible because these do not store static electric charges as much as synthetics.**

3. **Keep plastic, vinyl, and Styrofoam materials (such as plastic or Styrofoam cups, cup holders, cigarette packages, cellophane wrappers, vinyl books or folders, plastic bottles, and plastic ash trays) away from the device, the modules, and the work area as much as possible.**

4. **Do not remove any printed circuit board (PCB) from the device cabinet unless absolutely necessary. If you must remove the PCB from the device cabinet, follow these precautions:**
   - **Do not touch any part of the PCB except the edges.**
   - **Do not touch the electrical conductors, the connectors, or the components with conductive devices or with your hands.**
   - **When replacing a PCB, keep the new PCB in the plastic, anti-static protective bag it comes in until you are ready to install the PCB. Immediately after removing the old PCB from the device cabinet, place it in the anti-static protective bag.**

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What Is Included with the Device

The device package includes all connection terminals, except communication connectors, but does not include the fastening material. Please check the package for completeness upon delivery.

Device Package Contents:

- 1 – Protective Relay;
- 1 – Mount (Standard or Projection);
- 1 – Quick Start Guide (e.g for DT-3000 Users); and
- 2 – CDs
  - Disk 1 - Containing the User's Manual, Modbus Datapoint List, Wiring Diagram, and Device Template for Off-line Parameter Setting;
  - Disk 2 - Containing the PowerPort-E and Quality Manager software applications.

NOTICE **Disk1 contains the device templates. The device templates MUST BE installed to allow PowerPort-E to configure a device off-line.**

Please make sure the product label, wiring diagram, type code, and materials and description pertain to this device. If you have any doubts, please contact Eaton Corporation's Customer Service Department.

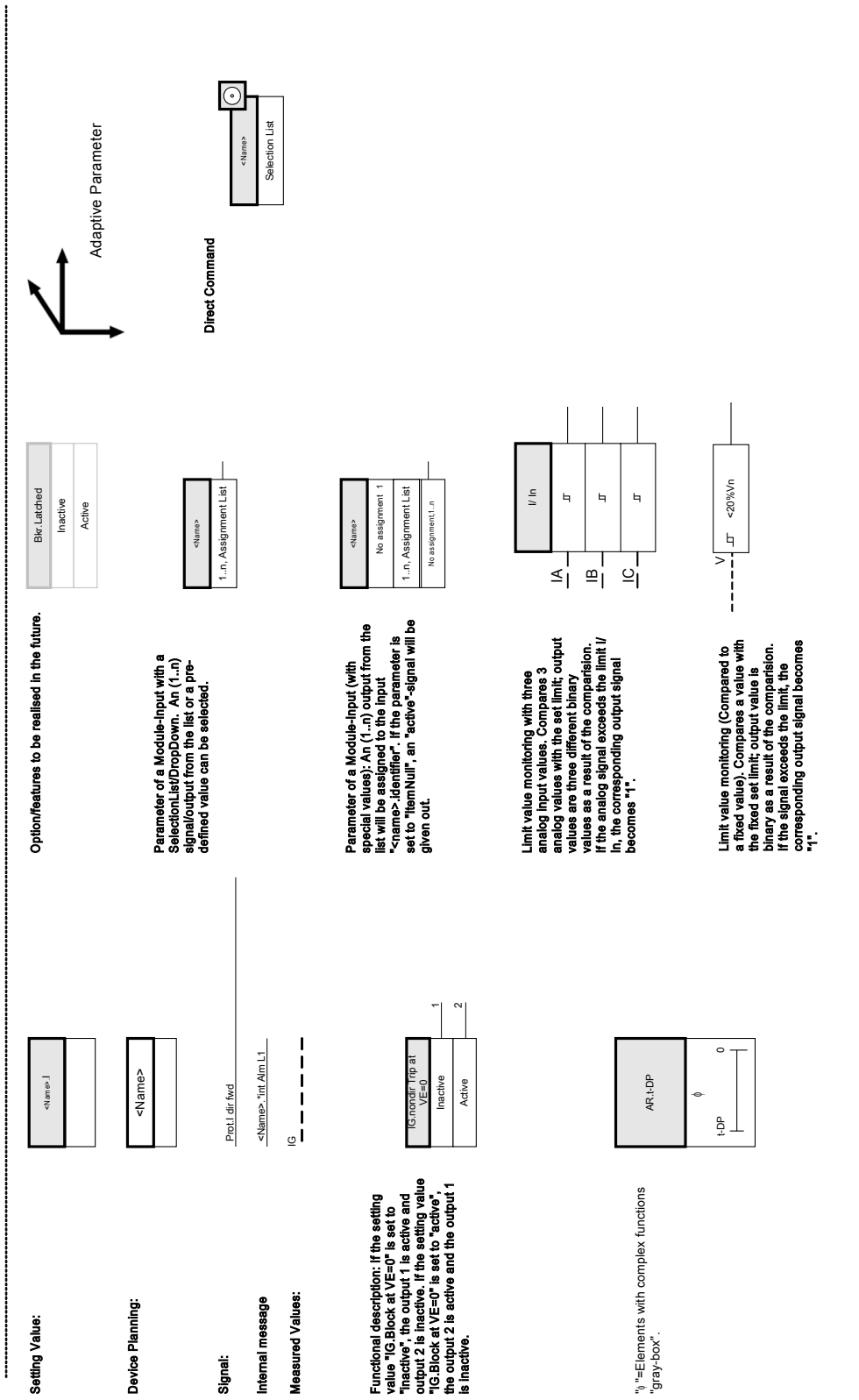
Storage

The devices must not be stored outdoors. If stored, it must be stored in an area with temperature and humidity control (see the Technical Data contained in this manual).

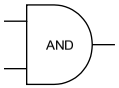
Important Information

WARNING **In line with the customer's requirement, the devices are combined in a modular way (in compliance with the order code). The terminal assignment of the device can be found on the top of the device (wiring diagram). In addition, it can be found within the Appendix of this manual (see Wiring Diagrams).**

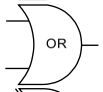
Symbols


Adaptive Parameter
Direct Command
Selection List
Bkr.Latched
Inactive
Active
1..n, Assignment List
No assignment 1
No assignment1..n
I/ In
<20%Vn
IA
IB
IC
V
Setting Value:
Device Planning:
Signal:
Internal message
Measured Values:
Prot.I dir fwd
IG
IG.nondir I trip at VE=0
AR.t-DP
t-DP
Option/features to be realised in the future.
Parameter of a Module-Input with a SelectionList/DropDown. An (1..n) signal/output from the list or a pre-defined value can be selected.
Parameter of a Module-Input (with special values): An (1..n) output from the list will be assigned to the input "<name> identifier". If the parameter is set to "ItemNull", an "active"-signal will be given out.
Limit value monitoring with three analog input values. Compares 3 analog values with the set limit; output values are three different binary values as a result of the comparision. If the analog signal exceeds the limit I/ In, the corresponding output signal becomes "1".
Limit value monitoring (Compared to a fixed value); Compares a value with the fixed set limit; output value is binary as a result of the comparision. If the signal exceeds the limit, the corresponding output signal becomes "1".
Functional description: If the setting value "IG.Block at VE=0" is set to "inactive", the output 1 is active and output 2 is inactive. If the setting value "IG.Block at VE=0" is set to "active", the output 2 is active and the output 1 is inactive.
"i) "=Elements with complex functions "gray-box"..

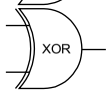
And



Or



Exclusive-XR

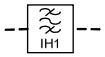


Inverting

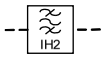
Negated Input

Negated Output

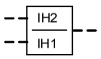
Band-pass (filter)
IH1



Band-pass (filter)
IH2



Quotient of Analog Values

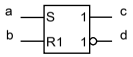


Analog Values

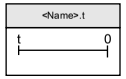
Analog Value Comparator

RS flip-flop

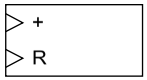
a	b	c	d
0	0	Unchanged	
0	1	0	1
1	0	1	0
1	1	0	1



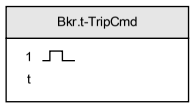
Time stage: A "1" at the input starts the element. If the time <name>.t is expired, the output becomes "1" too. The time stage will be reset by "0" at the input. Thus the output will be set to "0" at the same time.

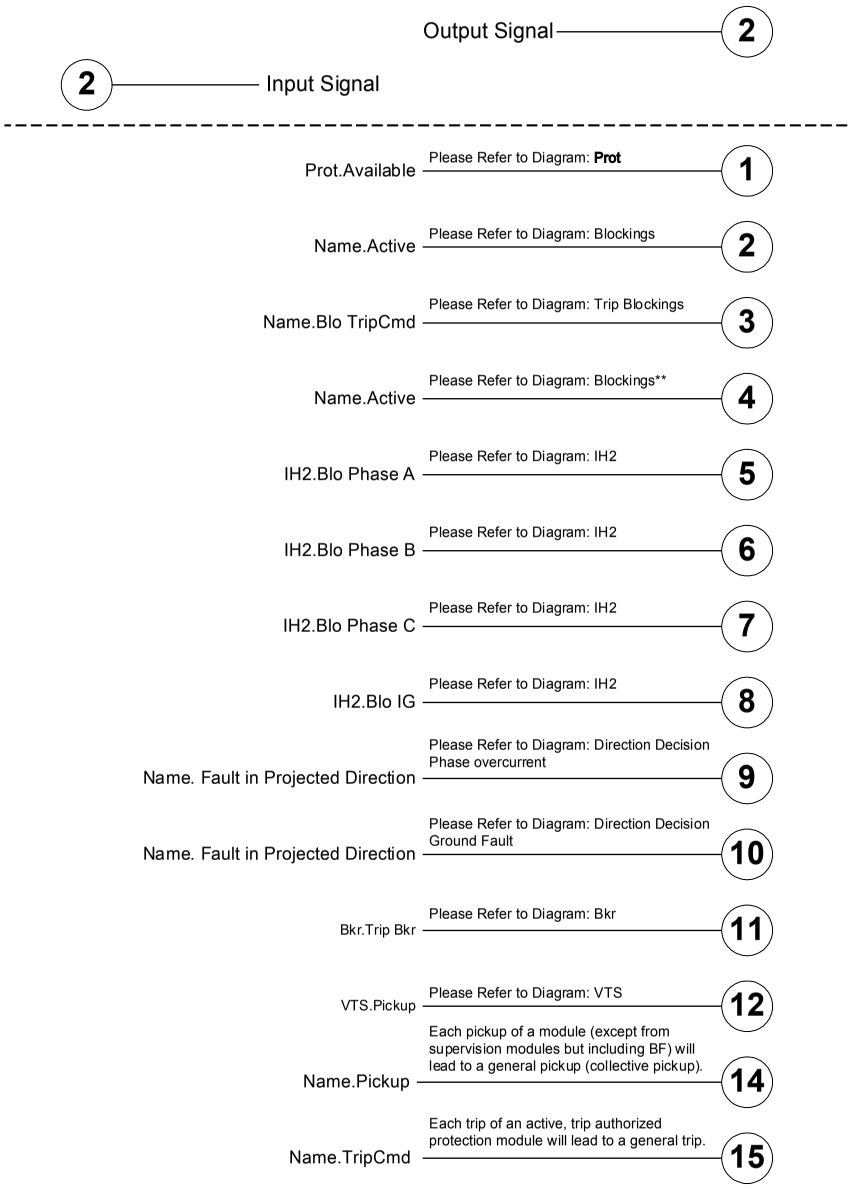


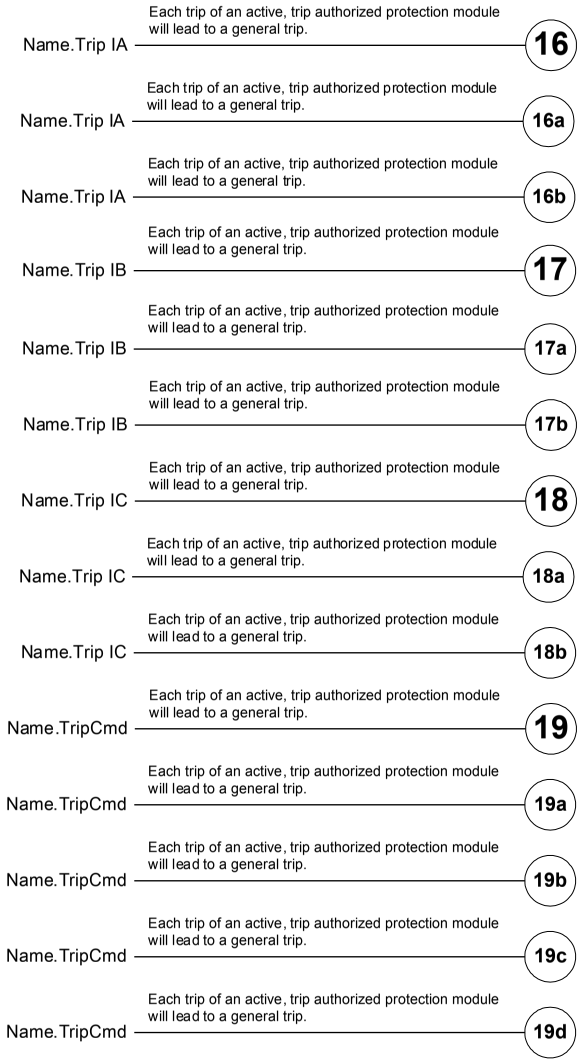
Edge triggered counter
+ Increment
R Reset

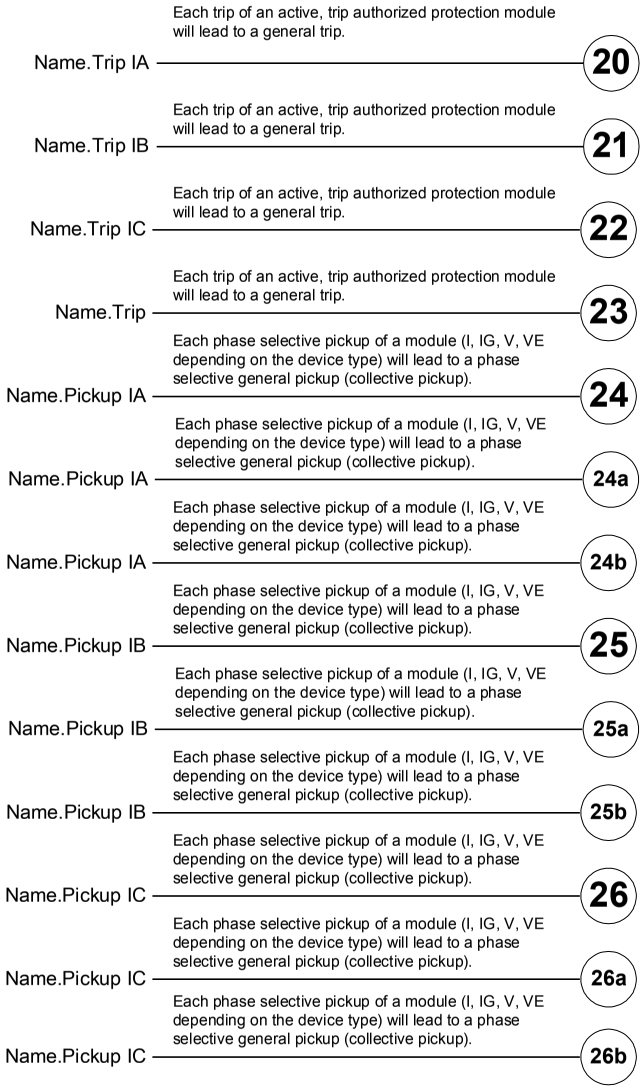


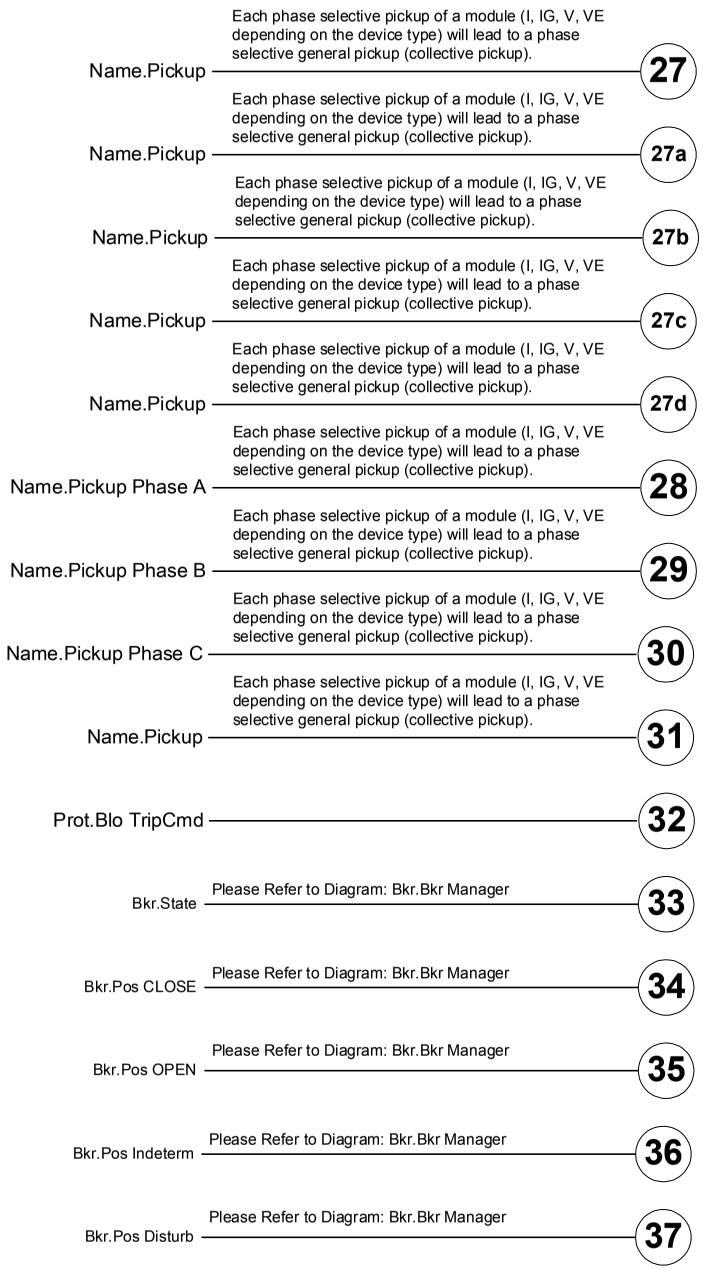
Time stage minimum pulse width: The pulse width <name>.t will be started if a "1" is feed to the input. By starting <name>.t, the output becomes "1". If the time is expired, the output becomes "0" independent from the input signal.




Output Signal
2
2
Input Signal
Prot.Available
Please Refer to Diagram: Prot
1
Name.Active
Please Refer to Diagram: Blockings
2
Name.Blo TripCmd
Please Refer to Diagram: Trip Blockings
3
Name.Active
Please Refer to Diagram: Blockings**
4
IH2.Blo Phase A
Please Refer to Diagram: IH2
5
IH2.Blo Phase B
Please Refer to Diagram: IH2
6
IH2.Blo Phase C
Please Refer to Diagram: IH2
7
IH2.Blo IG
Please Refer to Diagram: IH2
8
Name. Fault in Projected Direction
Please Refer to Diagram: Direction Decision Phase overcurrent
9
Name. Fault in Projected Direction
Please Refer to Diagram: Direction Decision Ground Fault
10
Bkr.Trip Bkr
Please Refer to Diagram: Bkr
11
VTS.Pickup
Please Refer to Diagram: VTS
12
Name.Pickup
Each pickup of a module (except from supervision modules but including BF) will lead to a general pickup (collective pickup).
14
Name.TripCmd
Each trip of an active, trip authorized protection module will lead to a general trip.
15


Name.Trip IA
Each trip of an active, trip authorized protection module will lead to a general trip.
16
Name.Trip IA
Each trip of an active, trip authorized protection module will lead to a general trip.
16a
Name.Trip IA
Each trip of an active, trip authorized protection module will lead to a general trip.
16b
Name.Trip IB
Each trip of an active, trip authorized protection module will lead to a general trip.
17
Name.Trip IB
Each trip of an active, trip authorized protection module will lead to a general trip.
17a
Name.Trip IB
Each trip of an active, trip authorized protection module will lead to a general trip.
17b
Name.Trip IC
Each trip of an active, trip authorized protection module will lead to a general trip.
18
Name.Trip IC
Each trip of an active, trip authorized protection module will lead to a general trip.
18a
Name.Trip IC
Each trip of an active, trip authorized protection module will lead to a general trip.
18b
Name.TripCmd
Each trip of an active, trip authorized protection module will lead to a general trip.
19
Name.TripCmd
Each trip of an active, trip authorized protection module will lead to a general trip.
19a
Name.TripCmd
Each trip of an active, trip authorized protection module will lead to a general trip.
19b
Name.TripCmd
Each trip of an active, trip authorized protection module will lead to a general trip.
19c
Name.TripCmd
Each trip of an active, trip authorized protection module will lead to a general trip.
19d


Each trip of an active, trip authorized protection module will lead to a general trip.
Name.Trip IA
20
Each trip of an active, trip authorized protection module will lead to a general trip.
Name.Trip IB
21
Each trip of an active, trip authorized protection module will lead to a general trip.
Name.Trip IC
22
Each trip of an active, trip authorized protection module will lead to a general trip.
Name.Trip
23
Each phase selective pickup of a module (I, IG, V, VE depending on the device type) will lead to a phase selective general pickup (collective pickup).
Name.Pickup IA
24
Each phase selective pickup of a module (I, IG, V, VE depending on the device type) will lead to a phase selective general pickup (collective pickup).
Name.Pickup IA
24a
Each phase selective pickup of a module (I, IG, V, VE depending on the device type) will lead to a phase selective general pickup (collective pickup).
Name.Pickup IA
24b
Each phase selective pickup of a module (I, IG, V, VE depending on the device type) will lead to a phase selective general pickup (collective pickup).
Name.Pickup IB
25
Each phase selective pickup of a module (I, IG, V, VE depending on the device type) will lead to a phase selective general pickup (collective pickup).
Name.Pickup IB
25a
Each phase selective pickup of a module (I, IG, V, VE depending on the device type) will lead to a phase selective general pickup (collective pickup).
Name.Pickup IB
25b
Each phase selective pickup of a module (I, IG, V, VE depending on the device type) will lead to a phase selective general pickup (collective pickup).
Name.Pickup IC
26
Each phase selective pickup of a module (I, IG, V, VE depending on the device type) will lead to a phase selective general pickup (collective pickup).
Name.Pickup IC
26a
Each phase selective pickup of a module (I, IG, V, VE depending on the device type) will lead to a phase selective general pickup (collective pickup).
Name.Pickup IC
26b


Each phase selective pickup of a module (I, IG, V, VE depending on the device type) will lead to a phase selective general pickup (collective pickup).
Name.Pickup
27
Each phase selective pickup of a module (I, IG, V, VE depending on the device type) will lead to a phase selective general pickup (collective pickup).
Name.Pickup
27a
Each phase selective pickup of a module (I, IG, V, VE depending on the device type) will lead to a phase selective general pickup (collective pickup).
Name.Pickup
27b
Each phase selective pickup of a module (I, IG, V, VE depending on the device type) will lead to a phase selective general pickup (collective pickup).
Name.Pickup
27c
Each phase selective pickup of a module (I, IG, V, VE depending on the device type) will lead to a phase selective general pickup (collective pickup).
Name.Pickup
27d
Each phase selective pickup of a module (I, IG, V, VE depending on the device type) will lead to a phase selective general pickup (collective pickup).
Name.Pickup Phase A
28
Each phase selective pickup of a module (I, IG, V, VE depending on the device type) will lead to a phase selective general pickup (collective pickup).
Name.Pickup Phase B
29
Each phase selective pickup of a module (I, IG, V, VE depending on the device type) will lead to a phase selective general pickup (collective pickup).
Name.Pickup Phase C
30
Each phase selective pickup of a module (I, IG, V, VE depending on the device type) will lead to a phase selective general pickup (collective pickup).
Name.Pickup
31
Prot.Blo TripCmd
32
Bkr.State
Please Refer to Diagram: Bkr.Bkr Manager
33
Bkr.Pos CLOSE
Please Refer to Diagram: Bkr.Bkr Manager
34
Bkr.Pos OPEN
Please Refer to Diagram: Bkr.Bkr Manager
35
Bkr.Pos Indeterm
Please Refer to Diagram: Bkr.Bkr Manager
36
Bkr.Pos Disturb
Please Refer to Diagram: Bkr.Bkr Manager
37

Terms, Abbreviations, and Acronyms

The following terms, abbreviations, and acronyms are used in this manual. Please refer to this section for their meanings / definitions.

A	Ampere(s), Amp(s)
AC	Alternating current
A/D	Analog to digital
Ack.	Acknowledge
AMP	Ampere(s), Amp(s)
AND	Logical gate (The output becomes true if all Input signals are true.)
ANG	Angle
ANSI	American National Standards Institute
AR	Automatic reclosure
AUX	Auxiliary
AVG, avg	Average
AWG	American wire gauge
BF	Breaker failure
BFI	Breaker failure initiate
BKR, bkr	Breaker
Blo	Blocking(s)
°C	Degrees Celsius
calc	Calculated
CB	Circuit breaker
CD	Compact disk
Char	Curve shape
CHK	Check
CHNL	Channel
Cmd.	Command
CMND	Command
CMN	Common input
COM	Common input
Comm	Communication
COMP	Compensated, comparison
CONN	Connection
CONT	Continuous, contact
CPU	Central processing unit
Cr.	Counter(s)
CRT, CRNT	Current
CSA	Canadian Standards Association
CT	Control transformer
Ctrl.	Control
CTS	Current transformer supervision
d	Day
D/A	Digital to analog
D-Sub-Plug	Communication interface
DC, dc	Direct current
DEFT	Definite time characteristic (Tripping time does not depend on the height of the current.)
DFLT	Default
DGNST	Diagnostics
DI	Digital Input
Diagn.	Diagnosis
Diagn Cr	Diagnosis counter(s)

DIFF	Differential
DIN	Deutsche Industrie Norm
DIR, dir	Directional
DMD	Demand
DPO	Dropout
DSP	Digital signal processor
dt	Rate of change
EINV	Extremely inverse tripping characteristic
EMC	Electromagnetic compatibility
EN	Europäische Norm
err. / Err.	Error
EVTcon	Parameter determines if the residual voltage is measured or calculated.
Ex	External
ExBlo	External blocking(s)
ExP	External protection
EXT	Extension, external
°F	Degrees Fahrenheit
F	Field
Fc	Function (Enable or disable functionality = allow or disallow.)
FIFO	First in first out
FIFO Principal	First in first out
FLA	Full load current
FO	Fiber optic
FTP	File transfer protocol
fund	Fundamental (ground wave)
FWD	Forward
G, g	Generator
gn	Acceleration of the earth in vertical direction (9.81 m/s^2)
GND	Ground
GPS	Global positioning system
h	Hour
HARM	Harmonic / harmonics
HMI	Human machine interface (Front of the protective relay)
HTL	Manufacturer internal product designation
HTTP	Hyper text transfer protocol
Hz	Hertz
I	Fault current
I	Current
I0	Zero current (symmetrical components), Zero sequence current
I1	Positive sequence current (symmetrical components)
I2	Negative sequence current (symmetrical components)
IA	Phase A current
IAB	Phase A minus B current
IB	Phase B current
IBC	Phase B minus C current
I-BF	Tripping threshold
IC	Phase C current
IC's	Manufacturer internal product designation
ICA	Phase C minus A current
ID	Identification
IEC	International Electrotechnical Commission
IED	Intelligent electronic device
IEEE	Institute of Electrical and Electronics Engineers

IG	Ground current (not residual)
IG	Fault current
Igd	Differential ground current
IGnom	Nominal ground current
IH1	Fundamental harmonic (1st harmonic)
IH2	2nd harmonic
IINV	Inverse
in.	Inch
incl.	Include, including
Info.	Information
Interl.	Interlocking
INV	Inverse characteristic (The tripping time will be calculated depending on the height of the current)
I/O	Input / output
IOC	Instantaneous overcurrent
IOV	Instantaneous overvoltage
IR	Calculated ground current
IRIG	Input for time synchronization (Clock), Inter-range instrumentation group
ISO	International Standards Organization
IT	Thermal Characteristic
I2T	Thermal Characteristic
I4T	Thermal Characteristic
IUV	Instantaneous undervoltage
IX	4th measuring input of the current measuring assembly group (either ground or neutral current)
J	Joule
kA	Kiloampere
kg	Kilogram
kHz	Kilohertz
kV	Kilovolt(s)
kVdc or kVDC	Kilovolt(s) direct current
L1	Phase A
L2	Phase B
L3	Phase C
I/In	Ratio of current to nominal current.
LED	Light emitting diode
lb-in	Pound-inch
LINV	Long time inverse tripping characteristic
LV	Low voltage
m	Meter
M	Machine
mA	Milliampere(s), Milliamp(s)
MAG	Magnitude
MAN, man.	Manual / manually
MAX, max.	Maximum
meas	Measured
MIN, min.	Minimum
min.	Minute
MINV	Moderately Inverse Tripping Characteristic
MK	Manufacturer Internal Product Designation Code
mm	Millimeter
MMU	Memory mapping unit
MRT	Minimum response time
ms	Milli-second(s)
MTA	Maximum torque angle

MTR	Motor
MV	Medium voltage
mVA	Milli volt amperes (Power)
MVA	Mega volt-ampere (total 3-phase)
MVA A	Mega volt-ampere (phase A)
MVA B	Mega volt-ampere (phase B)
MVA C	Mega volt-ampere (phase C)
MVAR	Mega Var (total 3-phase)
MVAR A	Mega Var (phase A)
MVAR B	Mega Var (phase B)
MVAR C	Mega Var (phase C)
MVARH	Mega Var-Hour
MW	Megawatt(s) (total 3-phase)
MW A	Megawatt(s) (phase A)
MW B	Megawatt(s) (phase B)
MW C	Megawatt(s) (phase C)
MWH	Megawatt-Hour(s)
N	Neutral
N/A, n/a	Not applicable
N.C.	Not connected
NEG	Negative
NINV	Normal inverse tripping characteristic
Nm	Newton-meter
No	Number
N.O.	Normal open (Contact)
NOM, Nom.	Nominal
NT	Manufacturer internal product designation code
O	Over
OC, O/C	Overcurrent
O/P, Op, OUT	Output
OV	Overvoltage
OVERFREQ	Overfrequency
OVLD	Overload
P	Phase
Para.	Parameter
PC	Personal computer
PCB	Printed circuit board
PE	Protected Earth
PF	Power factor (total 3-phase)
PF A	Power factor (phase A)
PF B	Power factor (phase B)
PF C	Power factor (phase C)
Ph	Phase
POS	Positive
PRESS	Pressure
PRI, pri	Primary
PROT, Prot	Protection Module (Master Module), protection
PS1	Parameter set 1
PS2	Parameter set 2
PS3	Parameter set 3
PS4	Parameter set 4
PSet	Parameter set
PSS	Parameter set switch (Switching from one parameter set to another)

pu	Per unit
PWM	Pulse width modulated
PWR	Power
R	Reset
rec.	Record
REF	Reference
rel	Relative
REM	Remote
res	Reset
ResetFct	Reset function
REV	Reverse
RevData	Review data
RMS	Root mean square
RO	Relay Output
RO1	1st Relay Output
RO2	2nd Relay Output
RO3	3rd Relay Output
Rst	Reset
RTD	Resistance-temperature detector
RX (Rx)	Receive, receiver
s	Second
S	Sensitive
SAT	CT saturation
SC	Supervision contact
Sca	SCADA
SCADA	Communication module, supervisory control and data acquistion
sec	Second(s)
SEC, sec	Secondary
SENS	Sensitive
SEQ	Sequence
Sig.	Signal
SNTP	Simple network time protocol
SRC	Source
StartFct	Start function
STATS	Statistics
Sum	Summation
SUPERV	Supervision
SW	Software
SYNC	Synchrocheck
SYNCHCHK	Synchrocheck
Sys.	System
t or t.	Time
t	Tripping delay
T	Time, transformer
Tcmd	Trip command
TCP	Transmission control protocol
TCP/IP	Communication protocol
TEMP, temp	Temperature
THD	Total harmonic distortion
TI	Manufacturer internal product designation code
TOC	Time overcurrent
TOV	Time overvoltage
TRANS	Transient

TripCmd	Trip command
TX (Tx)	Transmit, transmitter
txt	Text
UC	Undercurrent
UL	Underwriters Laboratories
UMZ	DEFT (definite time tripping characteristic)
URTD	Universal resistance-temperature detector
USB	Universal serial bus
V	Volts
V0	Zero sequence voltage
V1	Positive sequence voltage
V2	Negative sequence voltage
VA	Phase A voltage
VAB	Phase A to B voltage
Vac / V ac	Volts alternating current
VAG	Phase A to ground voltage
VARH	Var-hour voltage
VB	Phase B voltage
VBA	Phase B to A voltage
VBG	Phase B to ground voltage
VC	Phase C voltage
VCA	Phase C to A voltage
VCG	Phase C to ground voltage
Vdc / V dc	Volts direct current
VDE	Verband Deutscher Elektrotechnik
VDEW	Verband der Elektrizitätswirtschaft
VE	Residual voltage
V/Hz	Volts per Hertz
VINV	Very inverse tripping characteristic
VT	Voltage transformer
VTS	Voltage transformer supervision
W	Watt(s)
WDC	Watch dog contact (supervision contact)
WDG	Winding
WH	Watthour
www	World wide web
X	Reactance
XCT	4^{th} current measuring input (ground or neutral current)
XInv	Inverse characteristic
Z	Impedance, zone

Device

ETR-4000

Device Planning

The ETR-4000 relay has multiple functions. Depending on the particular application, the User may not need all the available functions. The device planning provides the User a means to enable the functions needed and disable those not needed at the top level so the User will not see the unused functions in the menu tree and all the corresponding events, signals, etc.

For example, if the User deactivates a protection function, all parameter branches related to that function will be hidden from the parameters. All corresponding events, signals, etc. will also be deactivated. Due to this device capability, the parameter trees become very transparent and only show the active functions.

WARNING

It MUST be taken into account that by deactivating any device function, the User also changes the functionality of the device. For example, if the User cancels the directional feature of the overcurrent protections, then the device no longer trips in a directional way but merely in a non-directional way.

Any time a device function is deactivated or activated, the device should be tested to insure its correct functioning for the application.

The manufacturer does not accept liability for any personal or material damage as a result of incorrect planning.

Contact your Eaton Customer Service representative for more information.

WARNING

Beware of the inadvertent deactivating of protective functions/modules.

If the User is deactivating modules within the device planning, all parameters of those modules will be set on default.

If the User is activating one of these modules, again, all parameters of those reactivated modules will be set on default.

NOTICE

If the protective device is equipped with Zone Interlocking, overcurrent and ground current elements are needed to trigger the Zone Interlocking function. Therefore, some overcurrent and ground current elements cannot be deactivated if the device is equipped with Zone Interlocking.

Device Planning Parameters of the Device

Parameter	*Description*	*Options*	*Default*	*Menu Path*
Hardware Variant 1	Optional Hardware Extension	»A« 2 Form A, 2 Form C, ZI,URTD	2 Form A, 2 Form C, ZI,URTD	[ETR-4000]
Hardware Variant 2	Optional Hardware Extension	»0« Without	»0« Without	[ETR-4000]
Communication	Communication	»B« Modbus RTU: RS485 / Terminals, »I« RS485 term / Ethernet	Modbus RTU: RS485 / Terminals	[ETR-4000]
Printed Circuit Board	Printed Circuit Board	»A« Standard, »B« Conformal Coating	»A« Standard	[ETR-4000]

There are two mounts available for the ETR-4000: a Standard Mount and a Projection Mount. To order the ETR-4000 with a Standard Mount, append the device code with a zero (0). To order the ETR-4000 with a Projection Mount, append the device code with a one (1). Refer to the table for details of the available device options.

CATALOG NUMBER	DESCRIPTION	STYLE NUMBER
ETR-4000A0BA0	8 DI, 9 Outputs, Removable Terminals, 2 Zone Interlocking, URTD Interface IRIG-B*, Phase Current 5A/1A, Ground Current 5A/1A, Power Supply Range: 19-300 Vdc, 40-250 Vac, Modbus-RTU (RS-485), No Conformal Coating on Circuit Boards, Standard Mount	66D2225G01
ETR-4000A0HA0	8 DI, 9 Outputs, Removable Terminals, 2 Zone Interlocking, URTD Interface IRIG-B*, Phase Current 5A/1A, Ground Current 5A/1A, Power Supply Range: 19-300 Vdc, 40-250 Vac, IEC-61850*, No Conformal Coating on Circuit Boards, Standard Mount	66D2225G02
ETR-4000A0IA0	8 DI, 9 Outputs, Removable Terminals, 2 Zone Interlocking, URTD Interface IRIG-B*, Phase Current 5A/1A, Ground Current 5A/1A, Power Supply Range: 19-300 Vdc, 40-250 Vac, Modbus-RTU + Modbus-TCP, No Conformal Coating on Circuit Boards, Standard Mount	66D2225G03
ETR-4000A1BA0	8 DI, 9 Outputs, Removable Terminals, 2 Zone Interlocking, URTD Interface IRIG-B*, Phase Current 5A/1A, Sensitive Ground Current 0.5A/0.1A, Power Supply Range: 19-300 Vdc, 40-250 Vac**, Modbus-RTU (RS-485), No Conformal Coating on Circuit Boards, Standard Mount	66D2225G04
ETR-4000A1HA0	8 DI, 9 Outputs, Removable Terminals, 2 Zone Interlocking, URTD Interface IRIG-B*, Phase Current 5A/1A, Sensitive Ground Current 0.5A/0.1A, Power Supply Range: 19-300 Vdc, 40-250 Vac**, IEC-61850*, No Conformal Coating on Circuit Boards, Standard Mount	66D2225G05
ETR-4000A1IA0	8 DI, 9 Outputs, Removable Terminals, 2 Zone Interlocking, URTD Interface IRIG-B*, Phase Current 5A/1A, Sensitive Ground Current 0.5A/0.1A, Power Supply Range: 19-300 Vdc, 40-250 Vac**, Modbus-RTU + Modbus-TCP, No Conformal Coating on Circuit Boards, Standard Mount	66D2225G06
ETR-4000A0BB0	8 DI, 9 Outputs, Removable Terminals, 2 Zone Interlocking, URTD Interface IRIG-B*, Phase Current 5A/1A, Ground Current 5A/1A, Power Supply Range: 19-300 Vdc, 40-250 Vac, Modbus-RTU (RS-485), Conformal Coating on Circuit Boards, Standard Mount	66D2225G07
ETR-4000A0HB0	8 DI, 9 Outputs, Removable Terminals, 2 Zone Interlocking, URTD Interface IRIG-B*, Phase Current 5A/1A, Ground Current 5A/1A, Power Supply Range: 19-300 Vdc, 40-250 Vac, IEC-61850*, Conformal Coating on Circuit Boards, Standard Mount	66D2225G08
ETR-4000A0IB0	8 DI, 9 Outputs, Removable Terminals, 2 Zone Interlocking, URTD Interface IRIG-B*, Phase Current 5A/1A, Ground Current 5A/1A, Power Supply Range: 19-300 Vdc, 40-250 Vac, Modbus-RTU + Modbus-TCP, Conformal Coating on Circuit Boards, Standard Mount	66D2225G09
ETR-4000A1BB0	8 DI, 9 Outputs, Removable Terminals, 2 Zone Interlocking, URTD Interface IRIG-B*, Phase Current 5A/1A, Sensitive Ground Current 0.5A/0.1A, Power Supply Range: 19-300 Vdc, 40-250 Vac**, Modbus-RTU (RS-485), Conformal Coating on Circuit Boards, Standard Mount	66D2225G10
ETR-4000A1HB0	8 DI, 9 Outputs, Removable Terminals, 2 Zone Interlocking, URTD Interface IRIG-B*, Phase Current 5A/1A, Sensitive Ground Current 0.5A/0.1A, Power Supply Range: 19-300 Vdc, 40-250 Vac**, IEC-61850*, Conformal Coating on Circuit Boards, Standard Mount	66D2225G11
ETR-4000A1IB0	8 DI, 9 Outputs, Removable Terminals, 2 Zone Interlocking, URTD Interface IRIG-B*, Phase Current 5A/1A, Sensitive Ground Current 0.5A/0.1A, Power Supply Range: 19-300 Vdc, 40-250 Vac**, Modbus-RTU + Modbus-TCP, Conformal Coating on Circuit Boards, Standard Mount	66D2225G12

CATALOG NUMBER	DESCRIPTION	STYLE NUMBER
ETR-4000A0BA1	8 DI, 9 Outputs, Removable Terminals, 2 Zone Interlocking, URTD Interface IRIG-B*, Phase Current 5A/1A, Ground Current 5A/1A, Power Supply Range: 19-300 Vdc, 40-250 Vac, Modbus-RTU (RS-485), No Conformal Coating on Circuit Boards, Projection Panel Mount	66D2225G13
ETR-4000A0HA1	8 DI, 9 Outputs, Removable Terminals, 2 Zone Interlocking, URTD Interface IRIG-B*, Phase Current 5A/1A, Ground Current 5A/1A, Power Supply Range: 19-300 Vdc, 40-250 Vac, IEC-61850*, No Conformal Coating on Circuit Boards, Projection Panel Mount	66D2225G14
ETR-4000A0IA1	8 DI, 9 Outputs, Removable Terminals, 2 Zone Interlocking, URTD Interface IRIG-B*, Phase Current 5A/1A, Ground Current 5A/1A, Power Supply Range: 19-300 Vdc, 40-250 Vac, Modbus-RTU + Modbus-TCP, No Conformal Coating on Circuit Boards, Projection Panel Mount	66D2225G15
ETR-4000A1BA1	8 DI, 9 Outputs, Removable Terminals, 2 Zone Interlocking, URTD Interface IRIG-B*, Phase Current 5A/1A, Sensitive Ground Current 0.5A/0.1A, Power Supply Range: 19-300 Vdc, 40-250 Vac**, Modbus-RTU (RS-485), No Conformal Coating on Circuit Boards, Projection Panel Mount	66D2225G16
ETR-4000A1HA1	8 DI, 9 Outputs, Removable Terminals, 2 Zone Interlocking, URTD Interface IRIG-B*, Phase Current 5A/1A, Sensitive Ground Current 0.5A/0.1A, Power Supply Range: 19-300 Vdc, 40-250 Vac**, IEC-61850*, No Conformal Coating on Circuit Boards, Projection Panel Mount	66D2225G17
ETR-4000A1IA1	8 DI, 9 Outputs, Removable Terminals, 2 Zone Interlocking, URTD Interface IRIG-B*, Phase Current 5A/1A, Sensitive Ground Current 0.5A/0.1A, Power Supply Range: 19-300 Vdc, 40-250 Vac**, Modbus-RTU + Modbus-TCP, No Conformal Coating on Circuit Boards, Projection Panel Mount	66D2225G18
ETR-4000A0BB1	8 DI, 9 Outputs, Removable Terminals, 2 Zone Interlocking, URTD Interface IRIG-B*, Phase Current 5A/1A, Ground Current 5A/1A, Power Supply Range: 19-300 Vdc, 40-250 Vac, Modbus-RTU (RS-485), Conformal Coating on Circuit Boards, Projection Panel Mount	66D2225G19
ETR-4000A0HB1	8 DI, 9 Outputs, Removable Terminals, 2 Zone Interlocking, URTD Interface IRIG-B*, Phase Current 5A/1A, Ground Current 5A/1A, Power Supply Range: 19-300 Vdc, 40-250 Vac, IEC-61850*, Conformal Coating on Circuit Boards, Projection Panel Mount	66D2225G20
ETR-4000A0IB1	8 DI, 9 Outputs, Removable Terminals, 2 Zone Interlocking, URTD Interface IRIG-B*, Phase Current 5A/1A, Ground Current 5A/1A, Power Supply Range: 19-300 Vdc, 40-250 Vac, Modbus-RTU + Modbus-TCP, Conformal Coating on Circuit Boards, Projection Panel Mount	66D2225G21
ETR-4000A1BB1	8 DI, 9 Outputs, Removable Terminals, 2 Zone Interlocking, URTD Interface IRIG-B*, Phase Current 5A/1A, Sensitive Ground Current 0.5A/0.1A, Power Supply Range: 19-300 Vdc, 40-250 Vac**, Modbus-RTU (RS-485), Conformal Coating on Circuit Boards, Projection Panel Mount	66D2225G22
ETR-4000A1HB1	8 DI, 9 Outputs, Removable Terminals, 2 Zone Interlocking, URTD Interface IRIG-B*, Phase Current 5A/1A, Sensitive Ground Current 0.5A/0.1A, Power Supply Range: 19-300 Vdc, 40-250 Vac**, IEC-61850*, Conformal Coating on Circuit Boards, Projection Panel Mount	66D2225G23

CATALOG NUMBER	DESCRIPTION	STYLE NUMBER
ETR-4000A1IB1	8 DI, 9 Outputs, Removable Terminals, 2 Zone Interlocking, URTD Interface IRIG-B*, Phase Current 5A/1A, Sensitive Ground Current 0.5A/0.1A, Power Supply Range: 19-300 Vdc, 40-250 Vac**, Modbus-RTU + Modbus-TCP, Conformal Coating on Circuit Boards, Projection Panel Mount	66D2225G24

* Consult factory for the availability of variants.

** Ground current measurement:

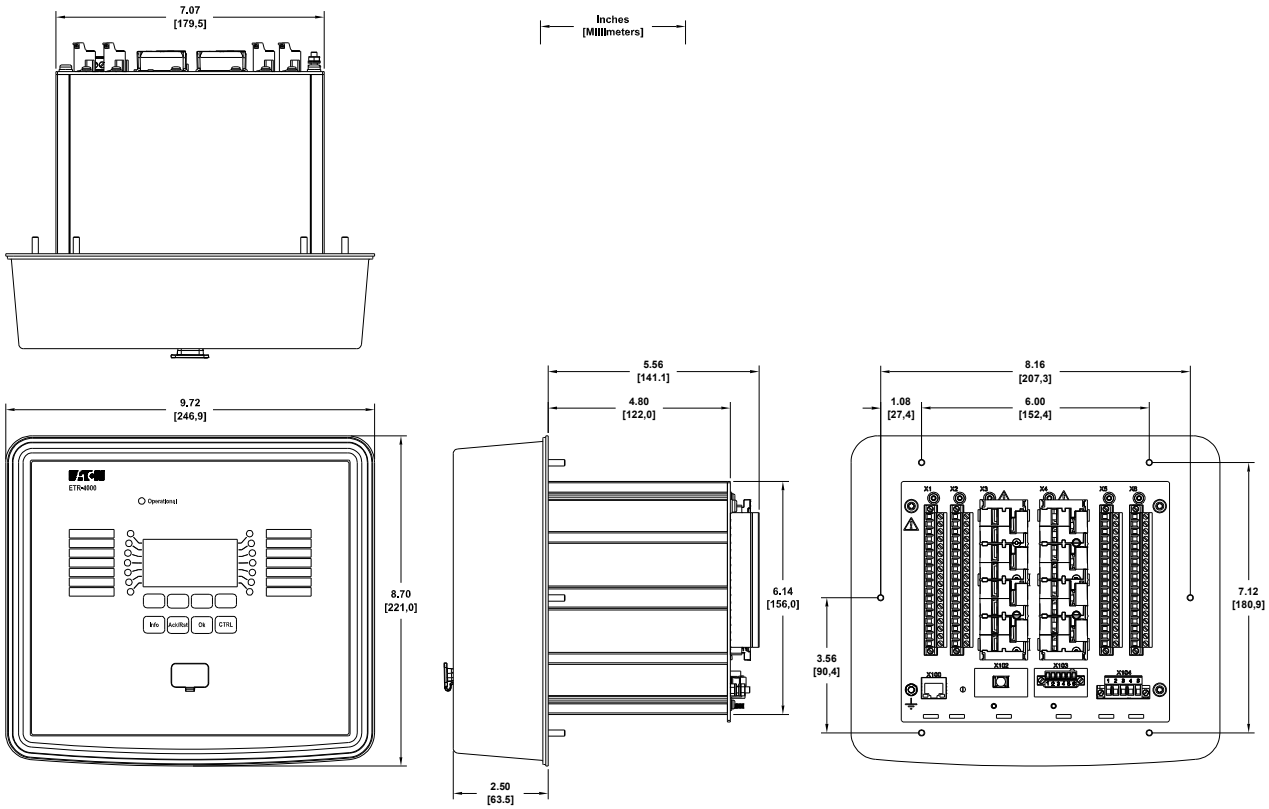
Four (4) variants are needed for DY / YY / YD /DD application in case of using the sensitive ground current variant.

In the U.S. market, DY connection is normally needed.

Installation and Connection

Three-Side-View

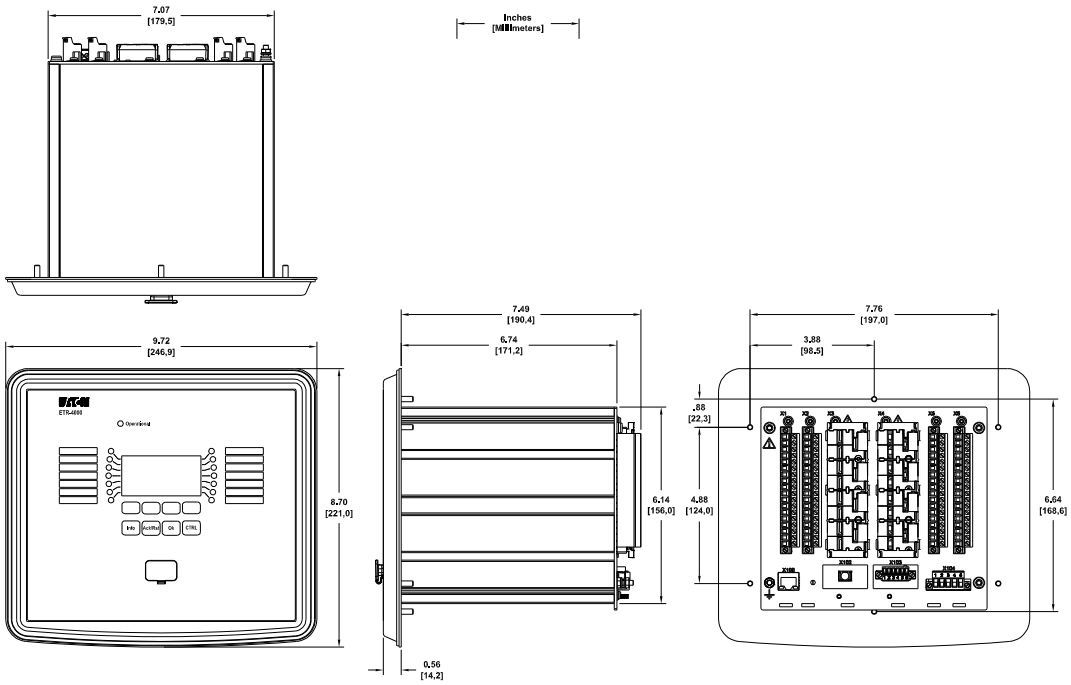
NOTICE **Depending on the connection method of the communication system used, the needed space (depth) differs. If, for instance, a D-Sub-Plug is used, it has to be added to the depth dimension.**



Outline Projection Mount

WARNING **The housing must be carefully grounded. Connect a ground cable (AWG 12-10 [4 to 6 mm^2] / 15 In-lb [1.7 Nm]) to the housing, using the screw that is marked with the ground symbol (at the rear side of the device).**

The power supply card needs a separate ground connection (AWG 14 [2.5 mm^2] / 5-7 In-lb [0.56-0.79 Nm]) at terminal X1.



Outline Standard Mount

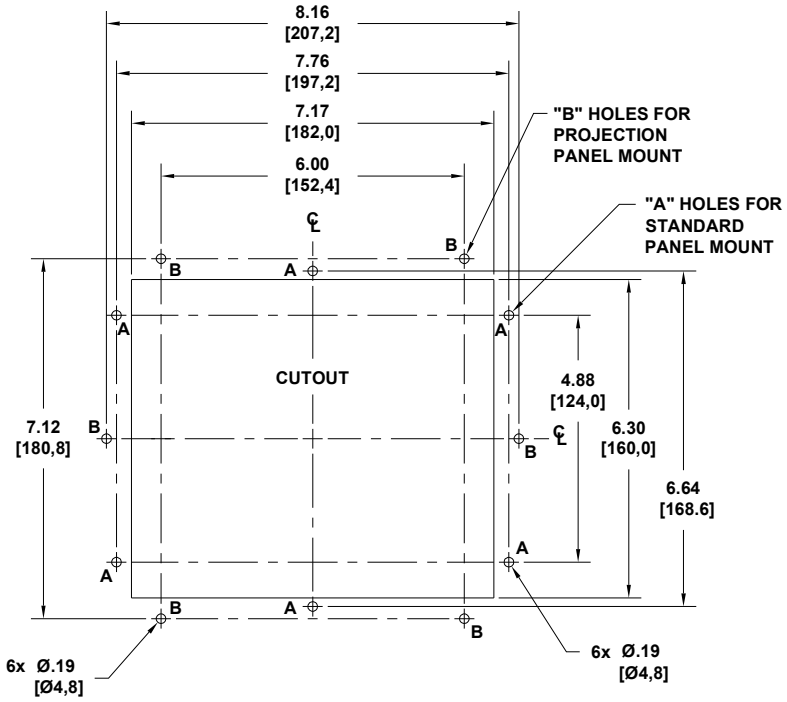
WARNING

The housing must be carefully grounded. Connect a ground cable (AWG 12-10 [4 to 6 mm^2] / 15 In-lb [1.7 Nm]) to the housing, using the screw that is marked with the ground symbol (at the rear side of the device).

The power supply card needs a separate ground connection (AWG 14 [2.5 mm^2] / 5-7 In-lb [0.56-0.79 Nm]) at terminal X1.

Installation Diagram

WARNING **Even when the auxiliary voltage is switched-off, unsafe voltages remain at the device connections.**



Door Cut-out

WARNING **The housing must be carefully grounded. Connect a ground cable (AWG 12-10 [4 to 6 mm^2] / 15 In-lb [1.7 Nm]) to the housing, using the screw that is marked with the ground symbol (at the rear side of the device).**

The power supply card needs a separate ground connection (AWG 14 [2.5 mm^2]) / 5-7 In-lb [0.56-0.79 Nm]) at terminal X1.

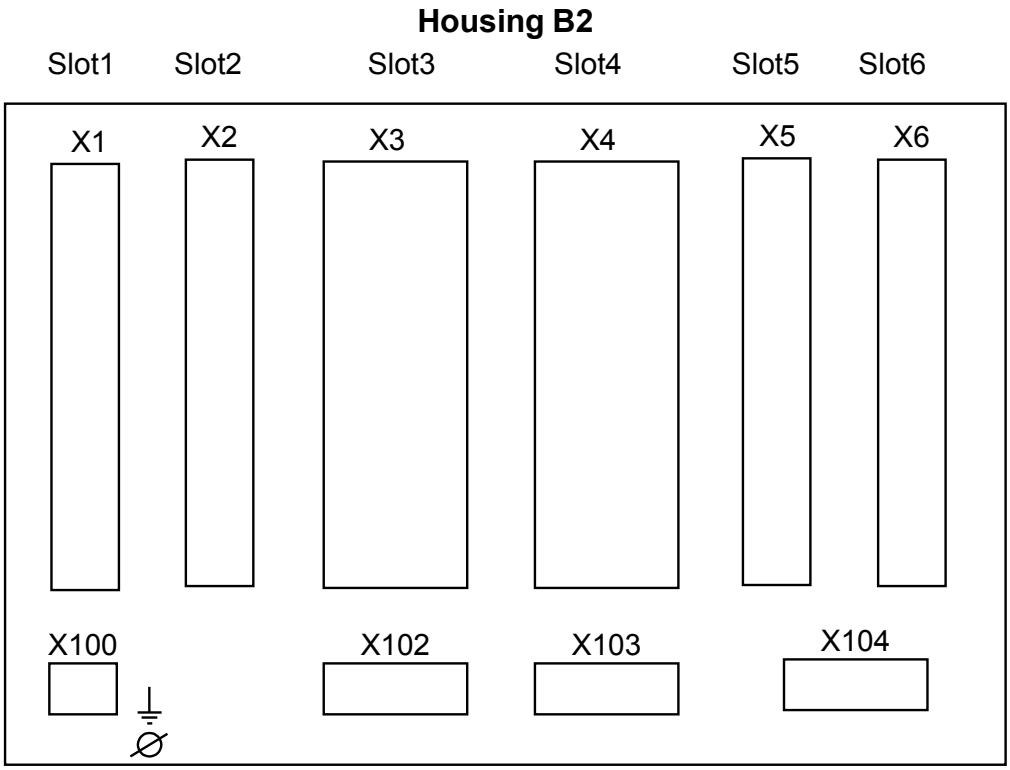
CAUTION **DO NOT over-tighten the mounting nuts of the relay (0.164 x 32). Check the torque by means of a torque wrench (15 lb-in [1.7 Nm]). Over-tightening the mounting nuts could cause personal injury or damage the relay.**

Assembly Groups

WARNING

In line with the customers' requirement, the devices are combined in a modular way (in compliance with the order code). In each of the slots, an assembly/group may be integrated. In the following diagram, the terminal assignment of the individual assembly/groups are shown. The exact installation/placement of the individual modules can be determined from the connection diagram attached to the top of your device.

Housing



Schematic Diagram

WARNING

The housing must be carefully grounded. Connect a ground cable (AWG 12-10 [4 to 6 mm^2] / 15 ln-lb [1.7 Nm]) to the housing, using the screw that is marked with the ground symbol (at the rear side of the device).

The power supply card needs a separate ground connection (AWG 14 [2.5 mm^2] / 5-7 ln-lb [0.56-0.79 Nm]) at terminal X1.

Grounding

WARNING

The housing must be carefully grounded. Connect a ground cable (AWG 12-10 [4 to 6 mm^2] / 15 In-lb [1.7 Nm]) to the housing, using the screw that is marked with the ground symbol (at the rear side of the device).

The power supply card needs a separate ground connection (AWG 14 [2.5 mm^2] / 5-7 In-lb [0.56-0.79 Nm]) at terminal X1.

CAUTION

The devices are very sensitive to electrostatic discharges.

Power Supply and Digital Inputs

WARNING **Make sure that the tightening torque is 5-7 In-lb [0.56-0.79 Nm].**

This assembly group comprises:

- A wide-range power supply unit; and
- Two non-grouped digital inputs,
- Six (6) digital inputs, grouped.

Auxiliary Voltage Supply

- The auxiliary voltage inputs (wide-range power supply unit) are non-polarized. The device can be powered with an AC or DC control voltage.

Digital Inputs

CAUTION **For each digital input group, the related voltage input range has to be configured. Wrong switching thresholds can result in malfunctions/wrong signal transfer times.**

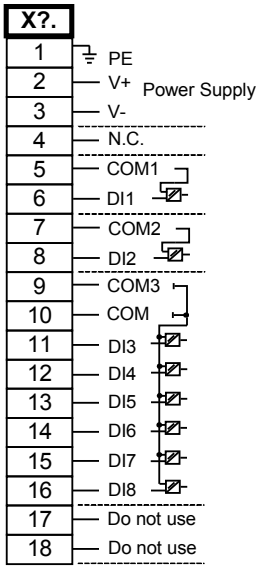
The digital inputs are provided with different switching thresholds (that are configurable) (two AC and five DC input ranges). The following switching levels can be defined:

- 24 Vdc;
- 48 Vdc
- 60 Vdc;
- 110/120 Vac/dc; and
- 230/240 Vac/dc.

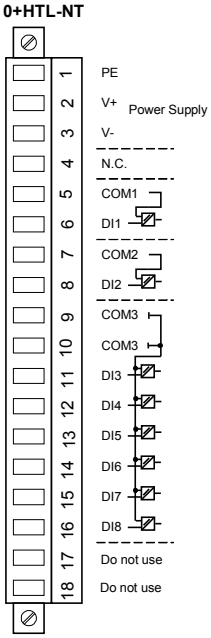
If a voltage >80% of the set switching threshold is applied at the digital input, the state change is recognized (logically “1”). If the voltage is below 40% of the set switching threshold, the device detects logically “0”.

CAUTION **When using DC supply the negative potential has to be connected to the common terminal (COM1, COM2, COM3, please see terminal marking).**

Terminal Marking => X1



Pin Assignment



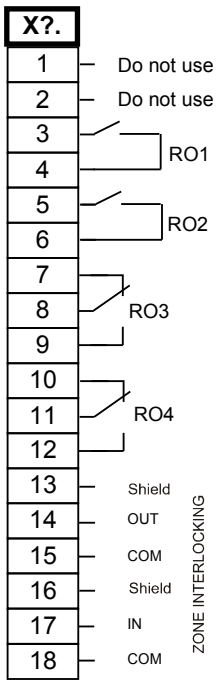
Relay Outputs

The number of the Relay Output contacts is related to the type of the device or type code. The Relay Outputs are “dry-type” contacts. In the Assignment/Relay Outputs section, the assignment of the Relay Outputs is specified. The changeable signals are listed in the Assignment List section.

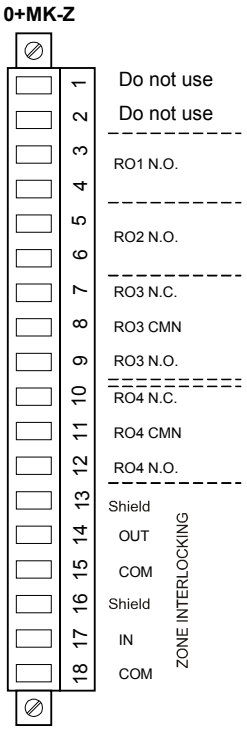
Make sure that the tightening torque is 5-7 In-lb [0.56-0.79 Nm].

Please carefully consider the current carrying capacity of the Relay Outputs. Please refer to the Technical Data section.

***Terminal Marking X2, X5** for Device: ETR-4000 (with Zone Interlocking)*

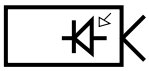


Pin Assignment for Device: ETR-4000 (with Zone Interlocking)



Interface for the URTD Module

The Universal Resistance-Temperature Detector (URTD) module has to be connected to the protective device at the special fiber optic interface (1 optical slave). The fiber optic interface is at position / Terminal X102.

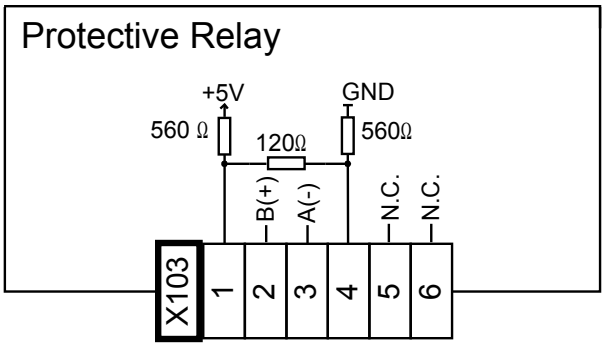
Terminal Marking X102	
Interface for the External URTD Module	Interface Ext. URTD Module
	

Communication Interface

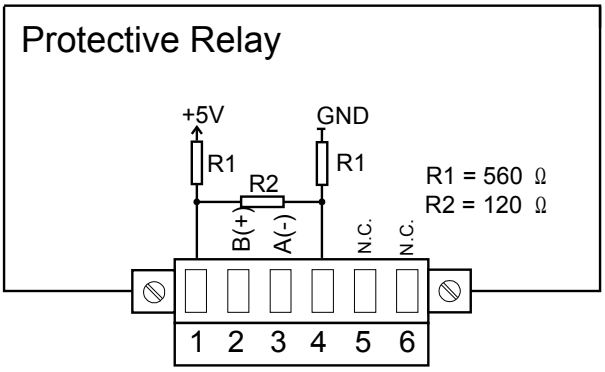
Modbus® RTU

WARNING **Make sure that the tightening torque is 2-4 In-lb [0.22-0.45 Nm].**

Terminal Marking X103 *for the Device:* ETR-4000



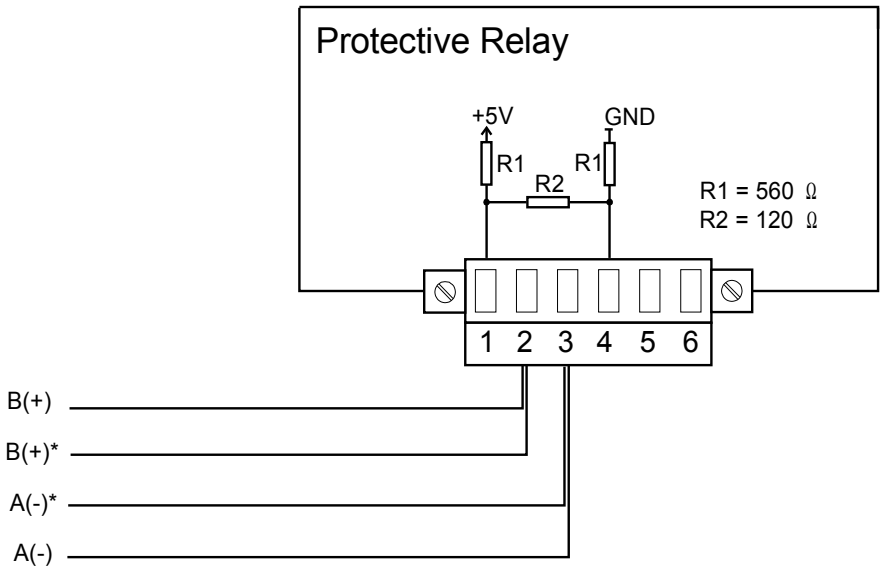
Pin Assignment for Device: ETR-4000



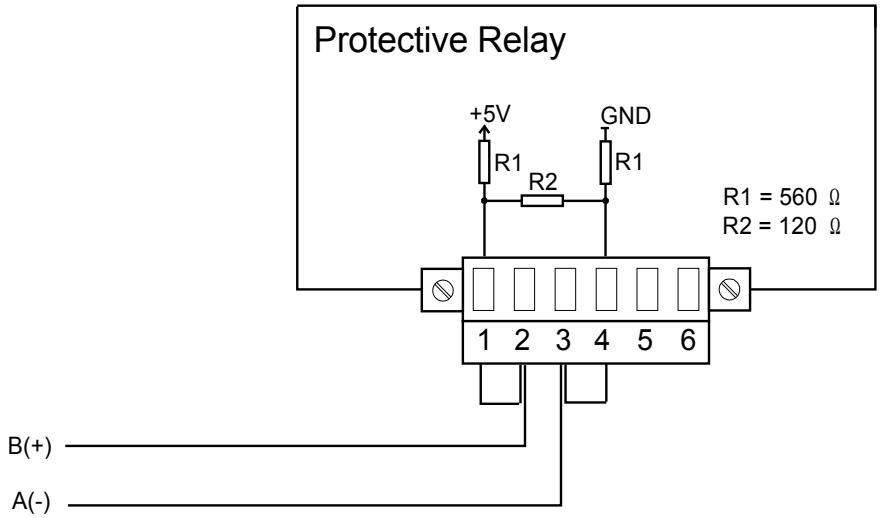
NOTICE **The Modbus® connection cable must be shielded. The shielding has to be fixed at the screw that is marked with the ground symbol at the rear side of the device.**

The communication is Half Duplex.

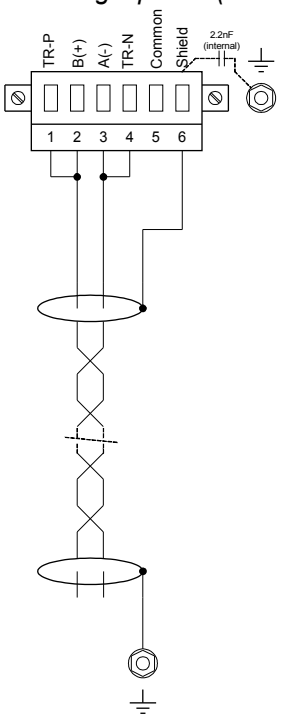
Wiring Example: Device in the Middle of the Bus



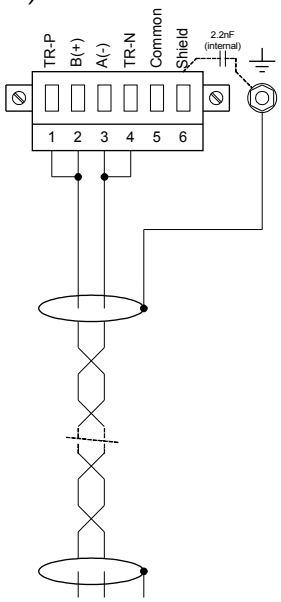
Wiring Example: Device at the End of the BUS (Using the Integrated Terminal Resistor)



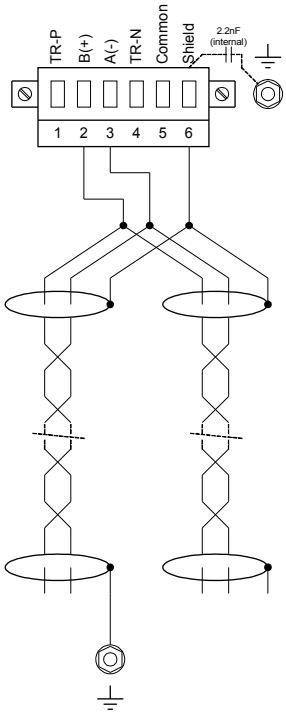
Shielding Options (2-wire + shield)



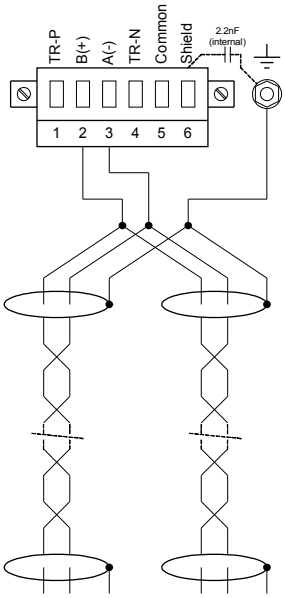
Shield at bus master side connected to earth termination resistors used



Shield at bus device side connected to earth termination resistors used

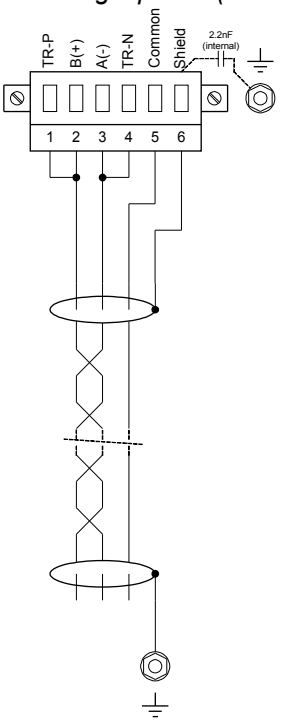


Shield at bus master side connected to earth termination resistors not used

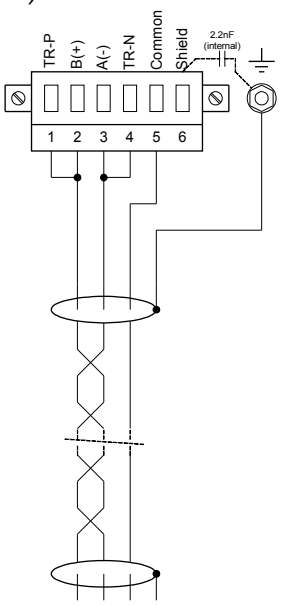


Shield at bus device side connected to earth termination resistors not used

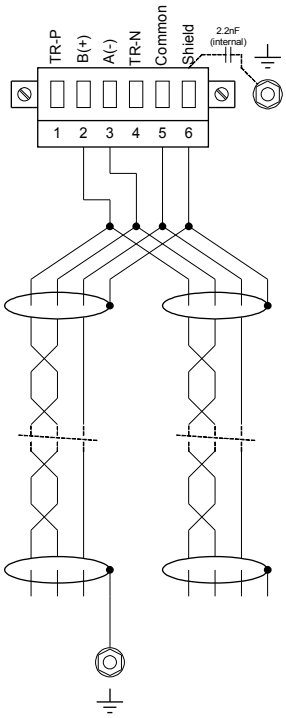
Shielding Options (3-wire + shield)



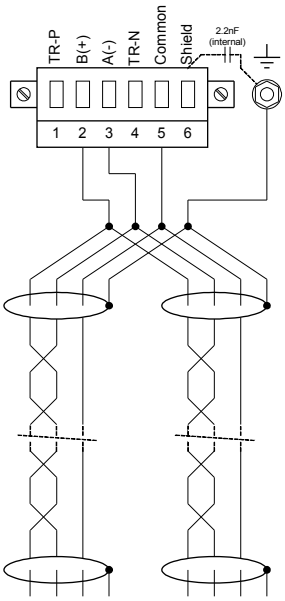
Shield at bus master side connected to earth termination resistors used



Shield at bus device side connected to earth termination resistors used



Shield at bus master side connected to earth termination resistors not used



Shield at bus device side connected to earth termination resistors not used

Current Measuring Inputs and Ground Current Measuring Input

A Current Measuring Card is provided with four (4) current measuring inputs: three for measuring the phase currents and one for measuring of the ground current. Each of the current measuring inputs has a measuring input for 1 A and
5 A.

The input for ground current measuring either can be connected to a zero sequence current transformer or, alternatively, it is possible to connect the summation current path of the phase current transformer to this input (residual connection).

DANGER **Current transformers have to be earth grounded on their secondary side.**

DANGER **Interrupting the secondary circuits of current transformers causes hazardous voltages.**

The secondary side of the current transformers have to be short circuited before the current circuit to the device is opened.

DANGER **The current measuring inputs may exclusively be connected to current measuring transformers (with galvanic separation).**

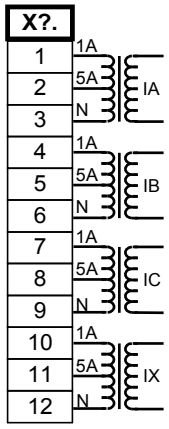
WARNING

- **Do not mix the inputs (1 A/5 A).**
- **Make sure the transformer ratios and the power of the CTs are correctly rated. If the rating of the CTs is not correct (overrated), then the normal operational conditions may not be recognized. The pickup value of the measuring unit amounts to approximately 3% of the rated current of the device. Also, the CTs need a current greater than approximately 3% of the rated current to ensure sufficient accuracy.**

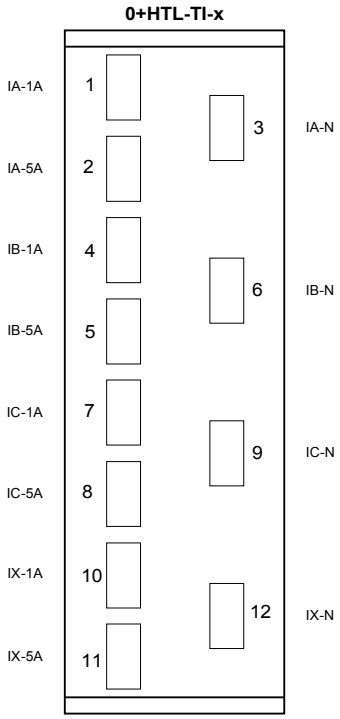
  Example: For a 600 A CT (primary current) any currents below 18 A cannot be detected.
- **Overloading can result in destruction of the measuring inputs or faulty signals. Overloading means that, in case of a short circuit, the current carrying capacity of the measuring inputs could be exceeded.**

WARNING **Make sure that the tightening torque is 17.7 In-lb [2 Nm].**

EDR-3000 Terminal Marking => X3
ETR-4000 Terminal Marking => X3,X4

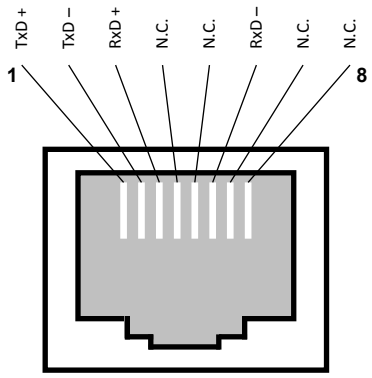


Pin Assignment



Ethernet - RJ45

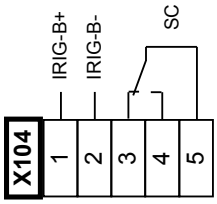
Terminal Marking X101



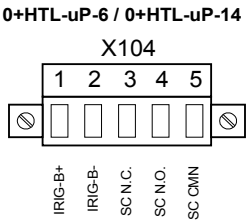
System Contact and IRIG-B

WARNING **Make sure that the tightening torque is 5-7 In-lb [0.56-0.79 Nm].**

Terminal Markings X104 *for Device:* ETR-4000



Pin Assignment for Device: ETR-4000

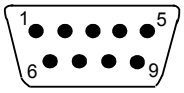


The Supervision Contact (SC) closes after the boot phase of the device if the protection is working. This Supervision Contact (SC) will open if an internal device error has occurred (please refer to the Self Supervision section).

PC Interface

X120 9-pole D-Sub at all device fronts.

Pin Assignment



1 DCD

2 RxD

3 TxD

4 DTR

5 GND

6 DSR

7 RTS

8 CTS

9 RI

Housing shielded

Assignment of the Null Modem Cable

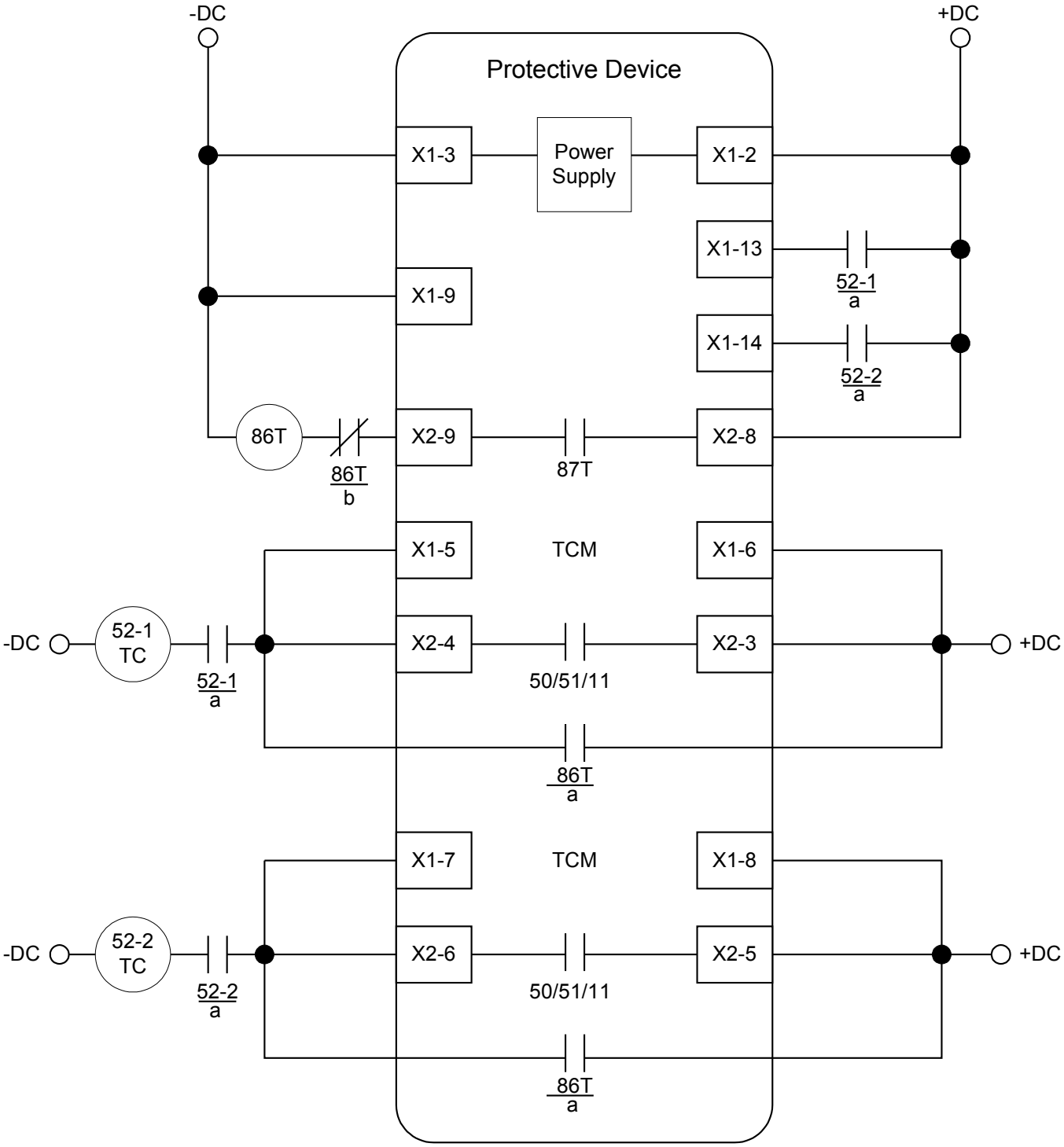
Assignment of the fully wired, null modem cable.

Dsub -9 (Female)	*Signal*	*Dsub -9 (Female)*	*Signal*
2	RxD	3	TxD
3	TxD	2	RxD
4	DTR	6,1	DSR, DCD
6,1	DSR, DCD	4	DTR
7	RTS	8	CTS
8	CTS	7	RTS
5	GND (Ground)	5	GND (Ground)
9	Ring signal	9	Ring signal

NOTICE **The connection cable must be shielded.**

Control Wiring Diagram

Below is the recommended control wiring schematic for the ETR-4000.



TCM = Trip Coil Monitor

Wiring Diagrams

Please refer to the file “etr-4000_wiring_diagrams.pdf” on your manual CD.

Current Transformers (CT)

Check the installation direction.

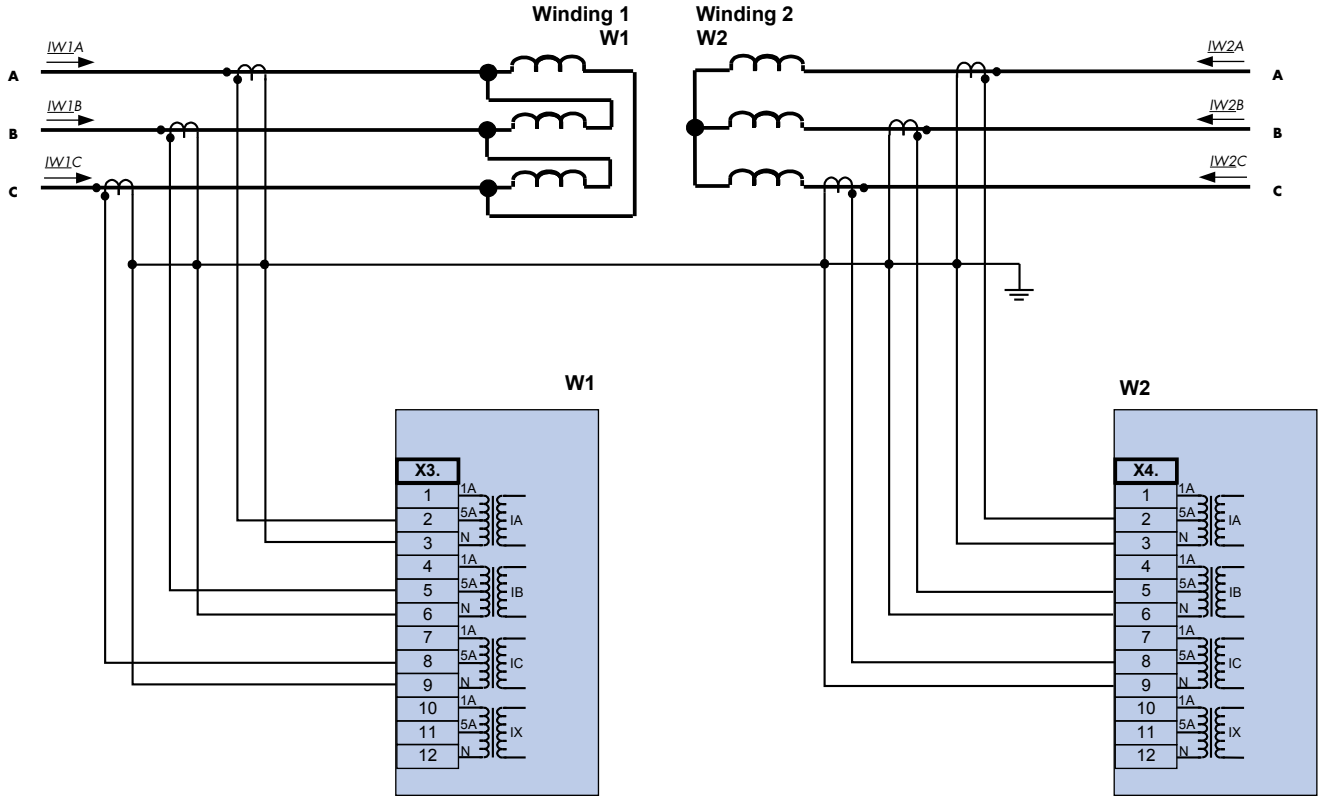
DANGER **It is imperative that the secondary sides of measuring transformers be grounded.**

DANGER **The current measuring inputs may exclusively be connected to current measuring transformers (with galvanic separation).**

WARNING **CT secondary circuits must always to be low-burdened or short-circuited during operation.**

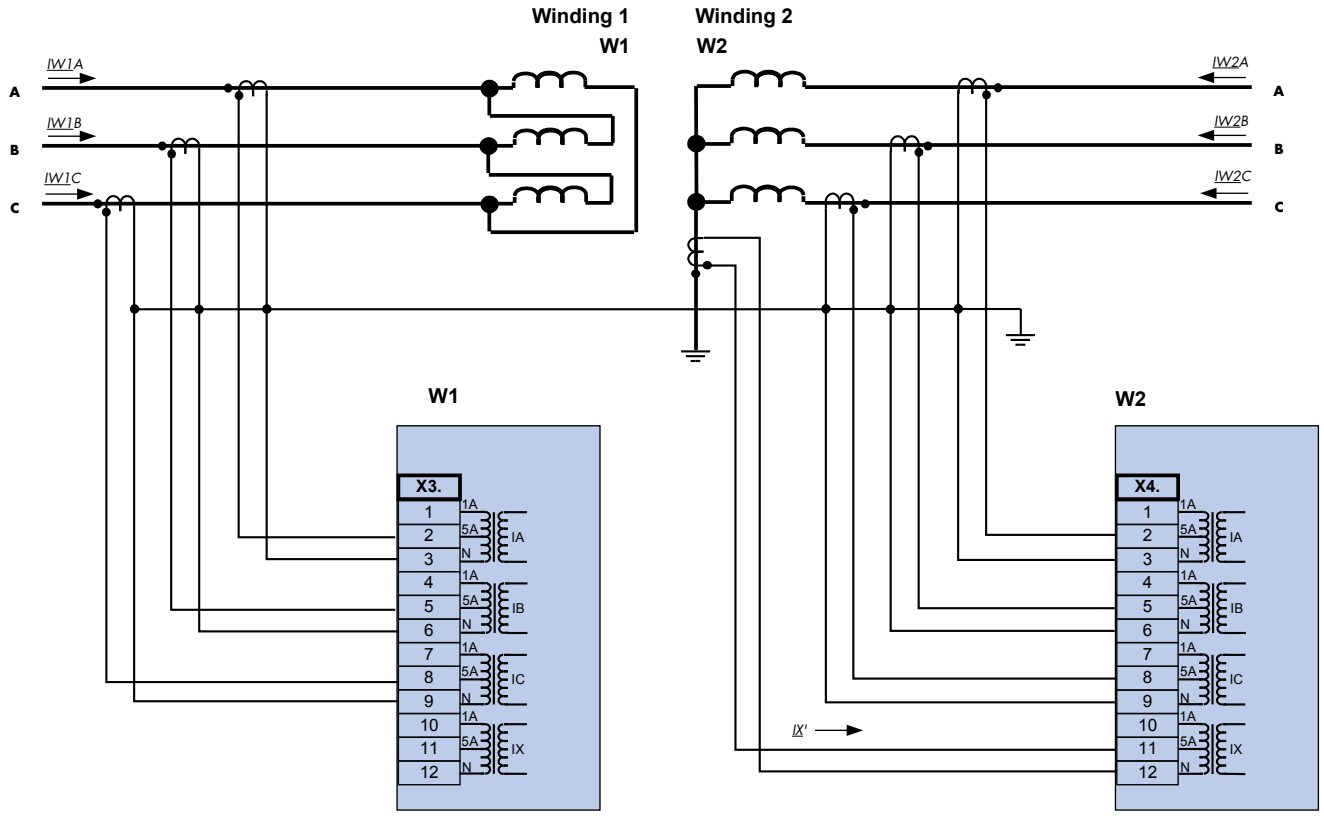
NOTICE **For current and voltage sensing function external wired and appropriate current and voltage transformer shall be used, based on the required input measurement ratings. Those devices provide the necessary insulation functionality.**

All current measuring inputs can be provided with 1 A or 5 A nominal. Make sure that the wiring is correct.



Three-phase Current Measurement; Inom Secondary = 5 A.

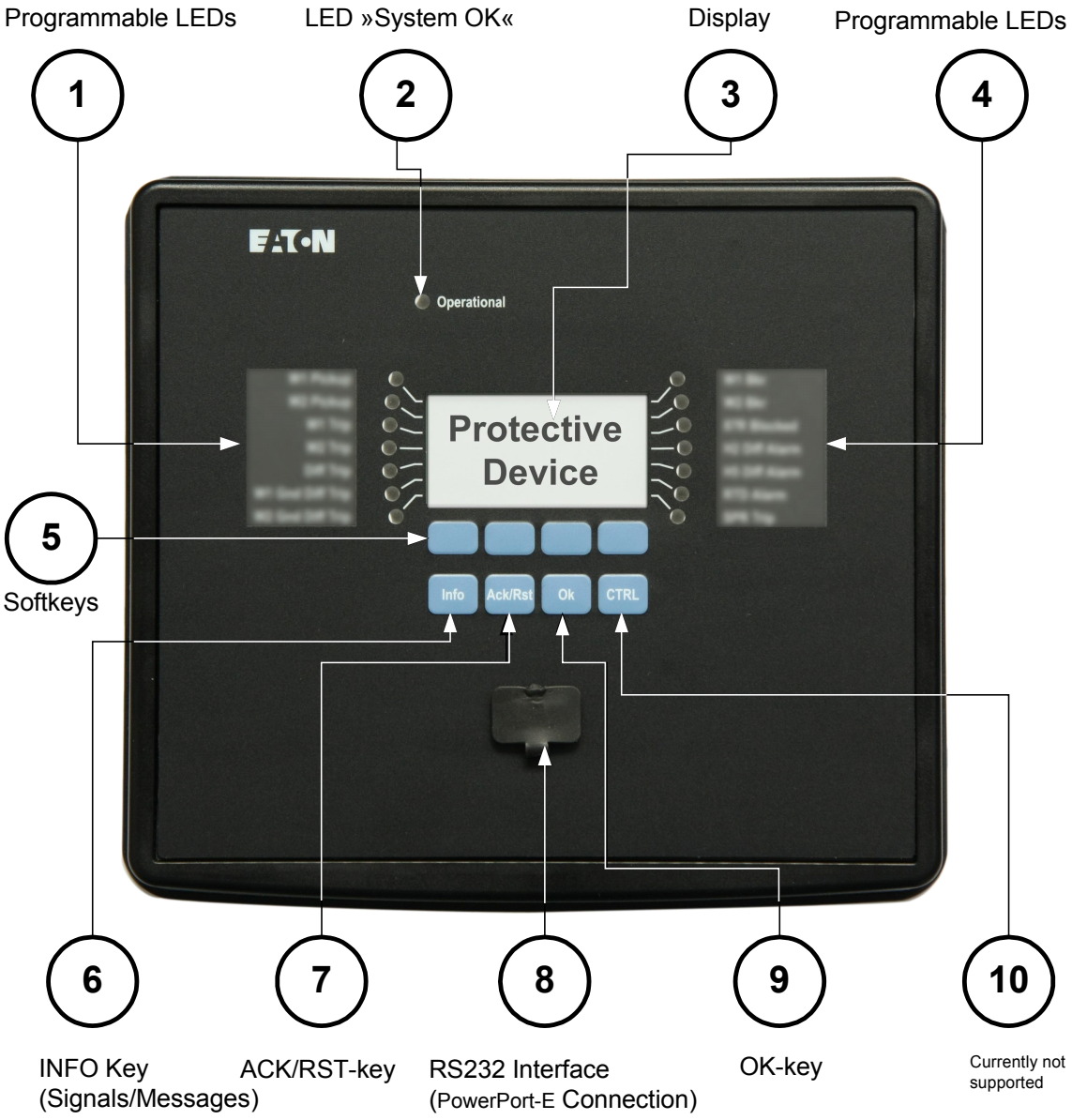
Three-phase Current Measurement; Inom Secondary = 5 A.

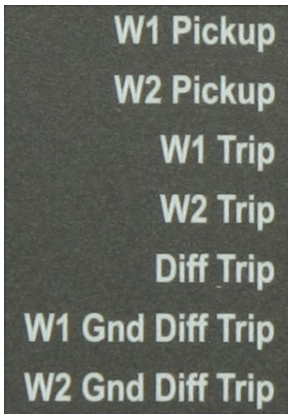
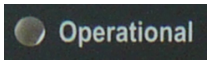
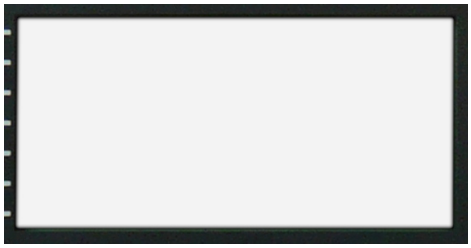


Three-phase Current Measurement; Inom Secondary = 5 A.

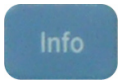
Three-phase Current Measurement; Inom Secondary = 5 A.

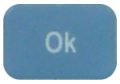
Navigation - Operation



Item	Graphic	Name	Description
1		Group A: Programmable LEDs	Basically there are 14 (7 on the left, 7 on the right side) programmable LEDs provided for user to configure, the choice for each programmable LED can be any signal from the global assignment list, which includes all internal operation states of each function activated. Based on the application need, up to 14 (but not necessary) programmable LEDs can be activated. By properly configuring some or all 14 LEDs, user will be able to view the relay overall operation and some critical information immediately and intuitively without digging into any menu.
2		LED »System OK«	Should the LED »System OK« flash red during operation, contact customer support immediately.
3		Display	Via the display, the User can view operational data and edit the parameters.
4		Group B: Programmable LEDs	Basically there are 14 (7 on the left, 7 on the right side) programmable LEDs provided for user to configure, the choice for each programmable LED can be any signal from the global assignment list, which includes all internal operation states of each function activated. Based on the application need, up to 14 (but not necessary) programmable LEDs can be activated. By properly configuring some or all 14 LEDs, user will be able to view the relay overall operation and some critical information immediately and intuitively without digging into any menu.

Item	Graphic	Name	Description
5		Softkeys	The function of the »SOFTKEYS« changes. Their active functions appear on the bottom line of the display. Possible functions are: • Navigation; • Parameter decrement/increment; • Scrolling up/down a menu page; • Moving to a digit; and • Change into the parameter setting mode »Wrench Symbol«.

Item	Graphic	Name	Description
6		INFO Key (Signals/Messages)	Looking through the present LED assignment. The Direct Select key can be activated at any time. If the INFO key is actuated again, the User will leave the LED menu. Here only the first assignments of the LEDs will be shown. Every three seconds the »SOFTKEYs« will be shown (flashing). *Displaying the Multiple Assignments* If the INFO key is pressed, only the first assignments of any LED is shown. Every three seconds the »SOFTKEYs« will be shown (flashing). If there is more than one signal assigned to an LED (indicated by three dots), the User can check the state of the multiple assignments by proceeding as follows. In order to show all (multiple) assignments, select an LED by means of the »SOFTKEYs« »up« and »down« Via the »Softkey« »right«, call up a sub-menu of this LED that gives the User detailed information on the state of all signals assigned to this LED. An arrow symbol points to the LED whose assignments are currently displayed. Via the »SOFTKEYs« »up« and »down«, the User can call up the next / previous LED. In order to leave the LED menu, press the »SOFTKEY« »left« multiple times.

Item	Graphic	Name	Description
7		»ACK/RST- Key«	To abort changes and to acknowledge messages as well as resetting counters. In order to reset, press the Softkey »Wrench« and enter the password. The User can exit the reset menu by pressing the Softkey »Arrow-left«
8		RS232 Interface (PowerPort-E Connection)	Connection to the software PowerPort-E is done via the RS232 interface.
9		»OK Key«	When using the »OK« key, parameter changes are temporarily stored. If the »OK« key is pressed again, those changes are stored indefinitely.
10		»CTRL Key«	Currently not supported.

Basic Menu Control

The graphic user interface is equivalent to a hierarchical structured menu tree. For access to the individual sub-menus, the »SOFTKEYS«/Navigation Keys are used. The function of the »SOFTKEYS« can be found near the bottom of the display.

Softkey	***Description***
	• Via »SOFTKEY« »Up«, the User will be taken to the prior menu point/one parameter up by scrolling upwards.
	• Via »SOFTKEY« »Left«, the User will be taken one step back.
	• Via »SOFTKEY« »Down«, the User will be taken to the next menu point/one parameter down by scrolling downwards.
	• Via »SOFTKEY« »Right«, the User will be taken to a sub-menu.
	• Via »SOFTKEY« »Top of List«, the User will be taken directly to the top of a list.
	• Via »SOFTKEY« »Bottom of List«, the User will be taken directly to the end of a list.
	• Via »SOFTKEY« »+«, the related digit will be incremented. (Continuous pressure -> fast).
	• Via »SOFTKEY« »-«, the related digit will be decremented. (Continuous pressure -> fast)
	• Via »SOFTKEY« »Left«, the User will be taken one digit to the left.
	• Via »SOFTKEY« »Right«, the User will be taken one digit to the right.
	• Via »SOFTKEY« »Parameter Setting«, the User will call up the parameter setting mode.
	• Via »SOFTKEY« »Delete«, data will be deleted.

In order to return to the main menu, just keep pressing the Softkey »Arrow-Left« until you arrive at the »Main Menu».

PowerPort-E Keyboard Commands

The User can control PowerPort-E alternatively by means of keyboard commands (instead of the mouse).

Key	*Description*
↑	Move up within the navigation tree or parameter list.
↓	Move down within the navigation tree or parameter list.
←	Collapse the tree item or select a folder on a higher level.
→	Expands the tree item or selects a sub-folder.
Numpad +	Expands the tree item.
Numpad -	Collapses the tree item.
Home	Moves to the top of the active window.
End	Moves to the bottom of the active window.
Ctrl+O	Opens the file opening dialog. Browsing through the file system for an existing device file.
Ctrl+N	Creates a new parameter file by means of a template.
Ctrl+S	Saves the actual loaded parameter file.
F1	Displays the on-line help information.
F2	Loads device data.
F5	Reloads the displayed data of a device.
Ctrl+F5	Enables the automatic refresh.
Ctrl+Shift+T	Moves back to the navigation window.
Ctrl+F6	Walks through the tabular forms (detail windows).
Page ↑	Moves to the previous value (parameter setting).
Page ↓	Moves to the next value (parameter setting).

PowerPort-E

PowerPort-E is software that is used to configure a device and read data from a device. *PowerPort-E* provides the following:

•Menu-controlled parameter setting including validity checks;
•Off-line configuration of all relay types;
•Reading and evaluation of statistical data and measuring values;
•Commissioning Support (Forcing Relays, Disarming Relays);
•Display of the device status; and
•Fault analysis via event and fault recorder.

Installation of PowerPort-E

NOTICE **Port 52152 must not be blocked by a Firewall. Otherwise the connection will be blocked.**

NOTICE **If the Windows Vista User Access Control pops up while installing *PowerPort-E*, please "Allow" all installation requirements concerning *PowerPort-E*.**

System Requirements: Windows 2000, Windows XP, or Windows Vista).

To install *PowerPort-E*:

- Double-click on the installation file with the left mouse button.
- Confirm by pressing the »Continue« button in the INFO frame.
- Select an installation path or confirm the standard installation path by mouse click on the »Continue« button.
- Confirm the entry for the suggested installation folder by mouse click on the »Continue« button.
- Start the installation process by mouse click on the »Install« button.
- Finish the installation procedure by mouse click on the »Complete« button.

If the suggested installation folder was chosen in the procedure above, the User can now call up the program via [Start > Programs > Eaton Relays> PowerPort-E].

Un-installing PowerPort-E

Via the [Start>System Control >Software] menu, the *PowerPort-E* application can be uninstalled from the computer.

Setting up the Serial Connection PC - Device

Set Up a Connection Via Serial Interface Under Windows 2000

After installation of the software, the »Connection PC/Notebook to the Device« has to be initially configured so that the User is able to read device data or re-write them into the device by means of the *PowerPort-E application.*

NOTICE **To connect the device to the User's PC/notebook, a special null modem cable is needed (no serial cable!- -please refer to the section »Null Modem Cable«).**

NOTICE **If the PC/notebook does not have a serial interface, the User will need a special *USB-to-serial-adapter.* If the *USB-to-serial-adapter* is correctly installed, communication with the device can be established using the CD provided (see the next section).**

NOTICE **The connection of the PC/notebook to the device MUST NOT be protected/encrypted via a smartcard.**

If the network connection wizard asks to encrypt the connection via a smartcard or not, please choose »Do not use the smartcard«.

Setting Up/Configuring the Connection

- Connect the PC/notebook with the device via a null modem cable.
- Start the *PowerPort-E* application.
- Select the menu point »Device Connection« in the »Settings« menu.
- Click on »Serial Connection«.
- Click the »Settings« button.
- When initially setting up the connection, a dialog window appears with the information that, so far, a direct connection with your protection device has not been established. Click on »Yes«.
- If, to this point, a location has not been set up on your PC, your location information has to be put in. Confirm the pop-up window »Telephone and Modem Options« with »OK«.
- The Windows network connection assistant appears after the location information is set up. Select the connection type »Establish direct connection to another computer«.
- Select the serial interface (COM-Port) where the device shall be connected.
- Select »To be used for all users« in the »Availability of the connection« window.
- Do not change the connection name appearing in window »Name of the connection« and click the button »Complete«.
- Finally, you arrive again in the window »Device Installation« from where you started establishing the connection. Confirm the adjustments by clicking the »OK« button.

NOTICE

Due to a problem in Windows 2000, it is possible that the automatically made communication settings are not correctly adopted. In order to overcome this problem, proceed as follows after setting up the serial connection.

- **Select the menu point »Device Connection« in the »Settings« menu.**
- **Select »Serial Connection«.**
- **Click on the »Settings« button.**
- **Change the register card to »General«.**
- **Ensure that »Communication cable between two computers Com X« is selected in the »Drop Down Menu«. X = the interface number where the User has connected the null modem cable.**
- **Click the »Configure« button.**
- **Ensure that the »Hardware Flowing Control« is activated.**
- **Ensure that a baud rate *»115200«* is selected.**

Set Up a Serial Connection Via Serial Interface Under Windows XP

After installation of the software, the »Connection PC/Notebook to the Device« has to be initially configured so that the User is able to read device data or re-write them into the device by means of the *PowerPort-E application.*

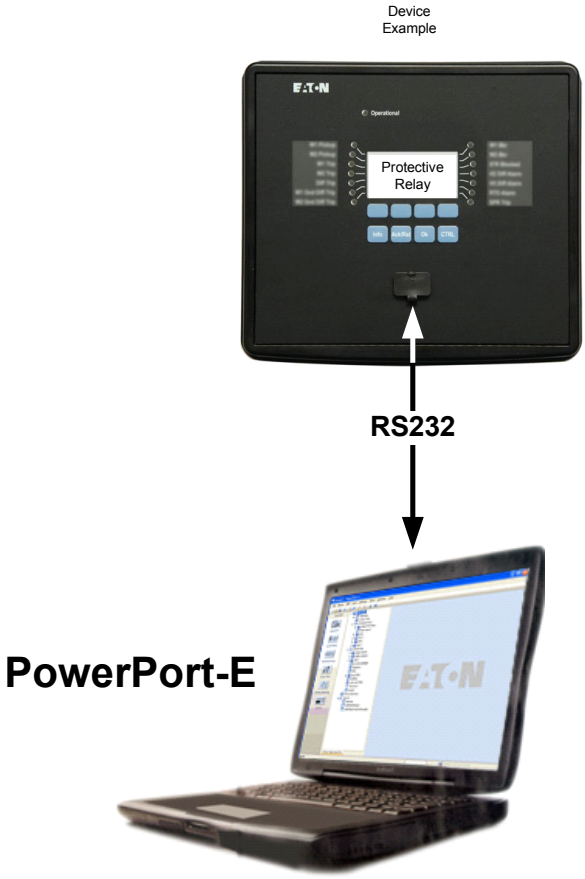
NOTICE **To connect the device to the User's PC/notebook, a special null modem cable is needed (no serial cable!- -please refer to the section »Null Modem Cable«).**

NOTICE **If the PC/notebook does not have a serial interface, the User will need a special *USB-to-serial-adapter.* If the *USB-to-serial-adapter* is correctly installed, communication with the device can be established using the CD provided (see the next section).**

Setting Up/Configuring the Connection

- Connect your PC/notebook with the device via a null modem cable.
- Start the *PowerPort-E application*.
- Select the menu point »Device Connection« in the »Settings« menu.
- Click on »Serial Connection«.
- Click the »Settings« button.
- When initially setting up the connection, a dialog window appears with the information that, so far, a direct connection with your protection device has not been established. Click on »Yes«.
- If, to this point, a location has not been set up on your PC, your location information has to be put in. Confirm the following pop-up window »Telephone and Modem Options« by selecting »OK«.
- The Windows network connection assistant appears after the location information is set up. Select the connection type »Establish direct connection to another computer«.
- Select the serial interface (COM-Port) where the device will be connected.
- Select »To be used for all users« in the »Availability of the connection« window.
- Do not change the connection name appearing in the »Name of the connection« window and click the »Complete« button.
- Finally, you arrive again in the »Device Installation« window where you started establishing the connection. Confirm the adjustments by clicking the »OK« button.

Parameter Setting and Evaluation via Serial/RS232



Set Up a Serial Connection Via Serial Interface Under Windows Vista

Establishing the connection between *PowerPort-E* and the device is a three step procedure:

1. Installing *PowerPort-E* (the application itself);
2. Installing a (virtual) modem (that is a precondition for TCP/IP communication via a null modem cable)/ (to be done within the control panel); and
3. Establishing a network connection between *PowerPort-E* and the device (to be done within PowerPort-E).

1. Installation of PowerPort-E (the application itself).

Refer to the “Installation of PowerPort-E” (earlier in this section).

2. Installation of the (Virtual) Modem.

•Call up the »Control Panel«.

•Choose »Hardware & Sound«.

•Choose »Phone & Modem Options«.

•Go to the »Modem« tab.

•Click on the »Add« button

•A new window »Install new modem**«** pops up.

•Set the check box »Don´t detect my modem**«.**

•Choose »I will select from list«.

•Click on the »Next« button.

•Choose the correct COM Port**.**

•Click on the »Next« button.

•Select »Computer cable between two computers**«.**

•Click on the »Properties« button.

•Go to the »General« tab.

•Click on the »Change Settings« button.

•Go to the »Modem« tab.

•Set within the Drop-Down Menu the correct **baud rate = 115200**

•Click on the »OK« button.

•Click on the »OK« button again.

•The User will now have to reboot the computer.

3. Establishing a Network Connection Between PowerPort-E and the Device.

•Connect the device to the PC/notebook via a correct null Modem-Cable.

•Run *PowerPort-E*.

•Call up »Device Connection« within the »Device Connection« menu.

•Click on the »Settings« button.

•A wizard will pop up asking you »How do you want to connect**«**.

•Choose »Dial-up«.

•The Telephone number must not be empty. Please enter any number (e.g.: 1).

•**Do not enter a User name and password**

•Click on the »OK« button.

Calling Up Web Site While Connected to a Device

In principle, it is possible to call up web sites *while* there is an active connection to the device.

If your computer has no direct connection to the Internet, that means that it is placed behind a proxy server. In certain circumstances, the device connection has to be modified. The device connection has to be provided with the proxy settings.

Internet Explorer

For each connection, the proxy settings have to be set manually. Please proceed as follows.

•Start your *Internet Explorer.*

•Call up the »Tools« menu.

•Call up the »Internet options« menu.

•Call up the »Connections« tab.

•Left click on the »Settings« button on the right of the »Device-Connection«.

•Set the check box »Use Proxy Server for this connection«.

•Enter the proxy settings that are available from your network administrator.

•Confirm the settings by pressing »OK«.

Firefox

The proxy settings are centrally managed, so there is no need to modify any settings.

Establishing the Serial Connection Via a USB-/RS232-Adapter

If your PC/notebook does not have an RS-232 interface, an *USB-/RS232-Adapter*+Null *Modem Cable can be used*.

NOTICE

Only an adapter approved by Eaton Corporation may be used. First install the adapter (with the related driver that you can find on the CD) and then establish the connection (*PowerPort-E => Device*). The adapters must support very high speed data transfer.

Set-up a Connection via Ethernet - TCP/IP

NOTICE **Establishing a connection via TCP/IP to the device is only possible if your device is equipped with an Ethernet Interface (RJ45).**

Contact your IT administrator in order to establish the network connection.

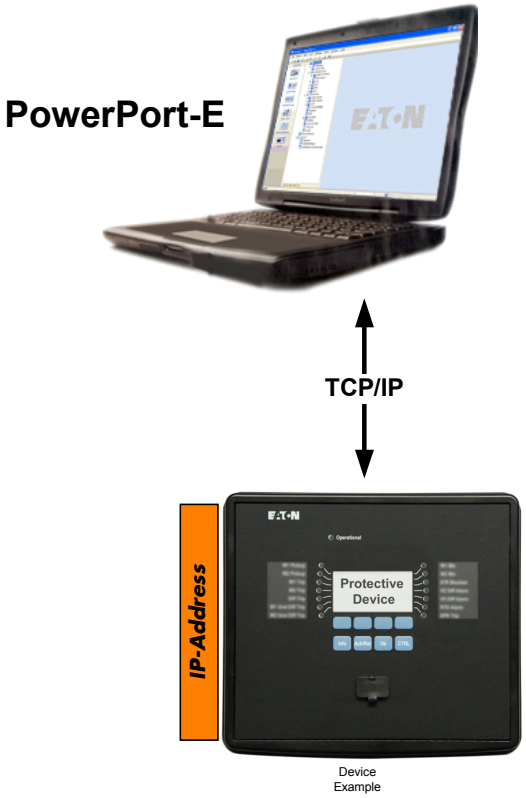
Part 1: Set the TCP/IP Parameters at the panel (Device)

Call up the menu *»Device parameter/TCP/IP«* at the HMI (panel) and set the following parameters:

- TCP/IP address
- Subnet mask
- Gateway

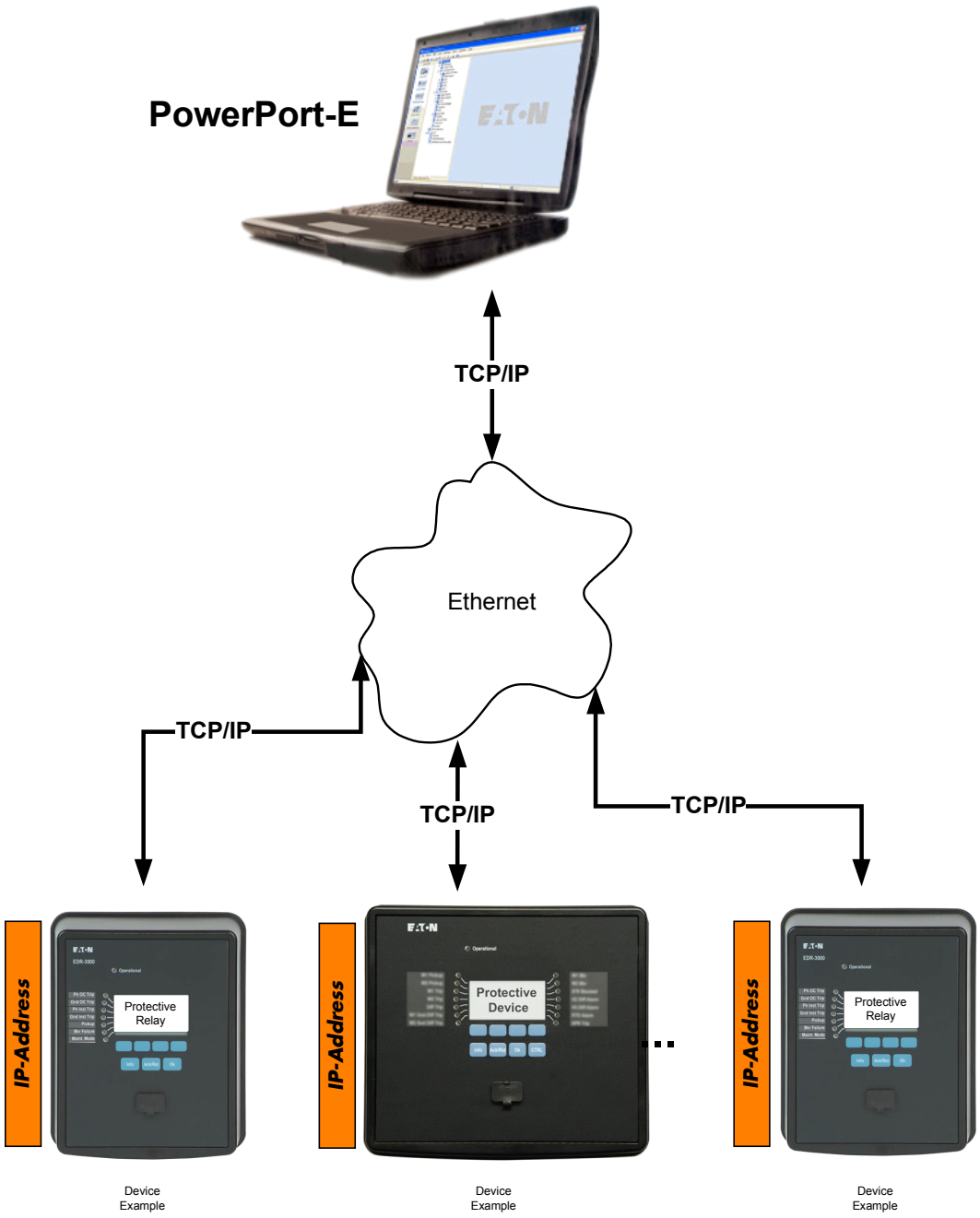
Part 2: Setting the IP address within PowerPort-E

- Call up the menu Settings/Device Connection within PowerPort-E.
- Set radio button Network Connection.
- Enter the IP-Address of the device that should be connected.



Parameter Setting and Evaluation via TCP/IP

Or:



Parameter Setting and Evaluation via TCP/IP

Set-up a Connection via Modbus Tunnel

NOTICE

Establishing a connection via a Gateway (TCP/IP)/Modbus RTU to the device is only possible if your device is equipped with an Ethernet Interface (RJ45).

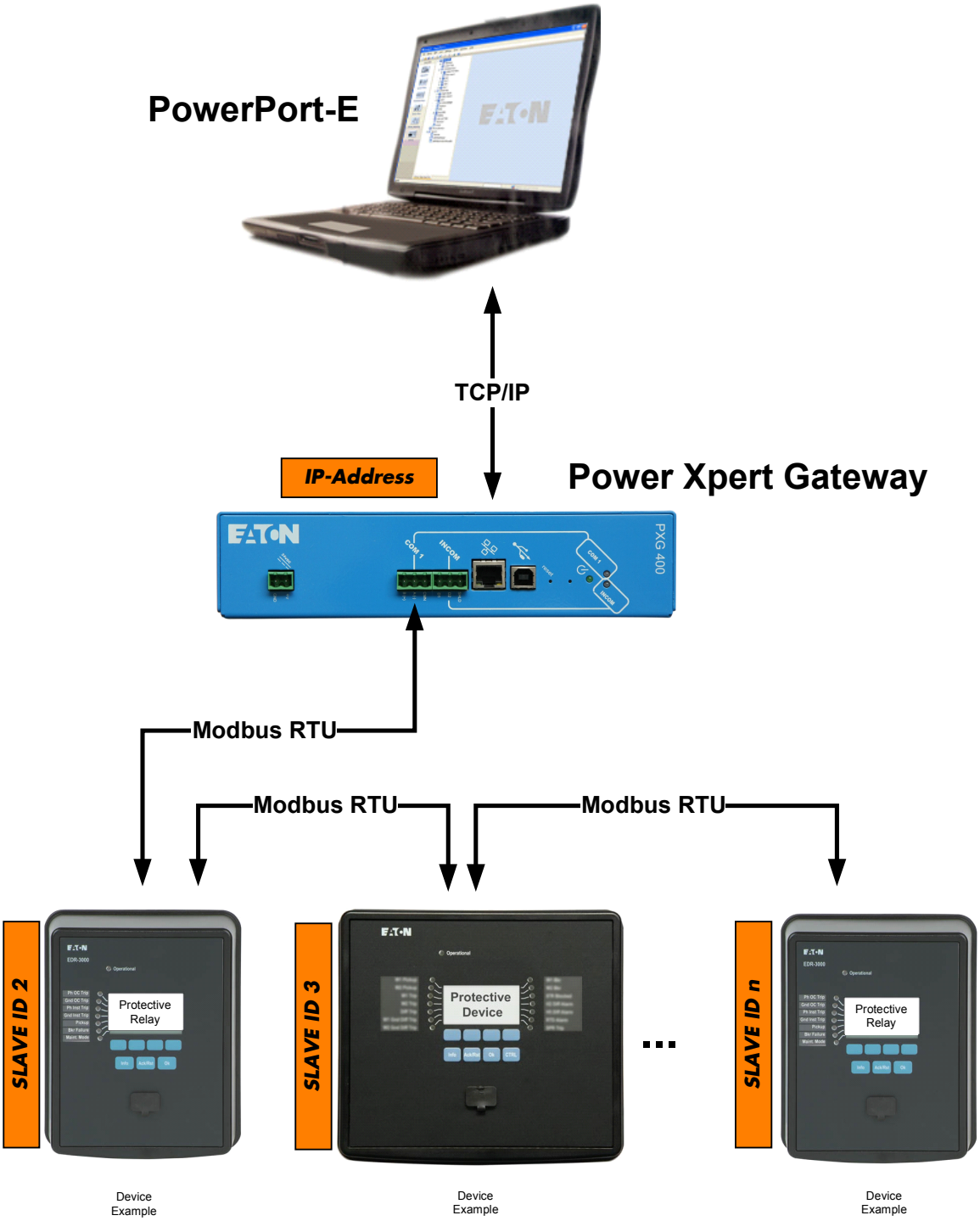
Contact your IT administrator in order to establish the network connection.

Part 1: If you don´t know the Slave ID of the device that should be connected via Modbus Tunnel, it can be read out at the device.

Call up the menu *»Device parameter/Modbus«* at the HMI (panel) and read out the Slave ID:

Part 2: Setting the IP address of the gateway and the Slave ID of the device that is to be connected via Modbus tunnel using PowerPort-E

- Call up the menu Settings/Device Connection within PowerPort-E.
- Set radio button Modbus TCP Gateway.
- Enter the IP-Address of the device that should be connected.
- Enter the Slave ID of the device.



Parameter Setting and Evaluation via Modbus Tunnel

PowerPort-E Troubleshooting

- Make sure that the Windows service *Telephony* is started. In [Start>System Control >Administration >Services] the service »Telephony« must be visible and must have been started. If not, the service has to be started.
- For establishing the connection, the User needs to have sufficient rights (administration rights).
- If a firewall is installed on your computer, TCP/IP port 52152 must have been released.
- If your computer does not have a serial interface, the User needs a *USB-to-serial-adapter*, approved by Eaton Corporation. This adapter has to be properly installed.
- Ensure that a null modem cable is used (a standard serial cable without control wires does not enable communication).

NOTICE

If a serial interface connection can not be established, and the User is running a Windows XP Operating System, the following may be the cause:

If a serial interface was selected in the connection assistant, it may be that this is not entered correctly in the dial-up network due to a bug in the Windows operating system. Your attention is drawn to this problem by the operational software and the error message »Warning, invalid connection setting« will be shown.

To solve this problem, you need administration rights.

Please proceed as follows.

- **Select the menu item »Device Connection« in the »Settings« menu.**
- **Select »Serial Connection«.**
- **Click the »Settings« button.**
- **Change the register card to »General«.**
- **Ensure that »Communication cable between two computers (Com X)« is selected in the Drop Down menu. »X« = the interface number where the null modem cable is connected.**

NOTICE

If the message »Warning, invalid connection settings« appears during establishment of the connection, it indicates that the connection adjustments chosen are not correct.

If this warning is displayed, the User may respond as follows.

»Yes«: (to set up a completely new connection).
By selecting »Yes«, all adjustments are canceled and the connection assistant is opened again for renewed adjustment of the connection to the device.

This procedure is advisable in case basic adjustments cannot be modified via the characteristics dialog (e.g.: if a new additional serial interface has been installed on the system).

»No«: (to modify the existing dial-up network entry).
Selecting »No« opens the dialog for characteristics of the connection settings. During the dialog, it is possible to correct invalid settings (e.g.: the recommended baud rate).

»Cancel«:
The warning is ignored and the connection adjustments remain as they are set. This procedure is accepted for a limited time, but the User is required to establish a correct connection at a later time.

PowerPort-E Persistent Connection Problems

In the case of persistent connection problems, the User should remove all connection settings and establish them again. In order to remove all connection settings, please proceed as follows.

1. *Remove the Settings for the Dial-up Network*

•Close PowerPort-E.

•Call up the »Control Panel«.

•Choose »Network & Internet«.

•On the left side, click on »Manage Network Connections«.

•Right click on »"Protective Device Name" Direct Connection«.

•Choose »Delete« from the shortcut menu.

•Click on the »OK« button.

2. *Remove the (Virtual) Modem*

•Call up the »Control Panel«.

•Choose »Hardware & Sound«.

•Choose »Phone & Modem Options«.

•Go to the »Modem« tab.

•Click on the correct (in case there is more than one) entry »Connection cable between two computers«.

•Click on the »Remove« button.

Loading of Device Data When Using PowerPort-E

- Start the *PowerPort-E application.*
- Make sure the connection has been established properly.
- Connect your PC with the device via a null *modem cable*.
- Select »Receiving Data From The Device« in the »Device« menu.

Restoring Device Data When Using PowerPort-E

WARNING

By selecting the »Transfer only modified parameters into the device« button only modified parameters are transmitted into the device.

Parameter modifications are indicated by a red “star symbol” in front of the parameter.

The star symbol (in the device tree window) indicates that parameters in the opened file (within PowerPort-E) differ from parameters stored on your local hard disk.

By selecting the »Transfer only modified parameters into the device« button, the User can transmit all parameters that are marked by this symbol.

If a parameter file is saved on the local hard drive, these parameters are no longer classified to be modified and cannot be transmitted via the »Transfer only modified parameters into the device« button.

In case the User has loaded and modified a parameter file from the device and saved it to the local hard drive without transferring the parameters into the device beforehand, the User cannot use the »Transfer only modified parameters into the device« button. In this case, use the »Transfer all parameters into the device« button.

NOTICE

The »Transfer only modified parameters into the device« button only works if modified parameters are available in the *PowerPort-E*.

In contrast, all parameters of the device are transferred when the »Transfer all parameters into the device« button is pressed (provided all device parameters are valid).

- In order to (re-)transfer changed parameters into the device, select »Transfer all parameters into the device« in the »Device« menu.
- Confirm the safety inquiry »Shall the parameters be overwritten into the device?«.
- Enter the password for setting parameters in the pop-up window.
- Thereafter, the changed data is transferred to the device and adopted.
- Confirm the inquiry »Parameters successfully updated?«. It is recommended to save the parameters into a local file on your hard drive. Confirm »Shall The Data Be Saved Locally?“« with »Yes« (recommended). Select a suitable folder on the hard disk.
- Confirm the chosen folder by clicking »Save«.
- The changed parameter data are now saved in the chosen folder.

Backup and Documentation When Using PowerPort-E

How to Save Device Data on a PC

Click on »Save as ...« in the »File« menu. Specify a name, choose a folder on the hard disk, and save the device data accordingly.

Printing of Device Data When Using PowerPort-E (Setting List)

The »Printing« menu offers the following options:

•Printer settings;

•Page preview;

•Printing; and

•Exporting the selected print range into a "txt" file.

The printing menu of the *PowerPort-E* software offers different types of printing ranges.

- *Printing of the complete parameter tree:*
  All values and parameters of the present parameter file are printed.
- *Printing of the displayed working window:*
  Only the data shown on the relevant working window are printed (i.e.: this applies, if at least one window is opened).
- *Printing of all opened working windows:*
  The data shown on all windows are printed (i.e.: this applies only if more than one window is opened).
- *Printing of the device parameter tree as from a shown position on:*
  All data and parameters of the device parameter tree are printed as from the position/marking in the navigation window. Below this selection, the complete name of the marking is additionally displayed.

Exporting Data as a “txt” File Via PowerPort-E

Within the print menu [File>Print], the User can choose »Export into File« in order to export the device data into a “txt” file.

NOTICE

When exporting data, only the actual selected printing range will be exported into a “txt” file. That means that if the User has chosen the “Complete device parameter tree” printing range, then the “Complete device parameter tree” will be exported. But, if the User has chosen “Actual working window” printing range, only that range of data will be exported.

This is the only method available to export data via PowerPort-E.

NOTICE

If the User exports a “txt” file, the content of this file is encoded as Unicode. That means that, if the User wants to edit this file, the application must support Unicode encoded files (e.g.: Microsoft Office 2003 or higher).

Off-line Device Planning Via PowerPort-E

NOTICE

In order to be able to transmit a parameter file (e.g.: created off-line) into the device, the following information must be located:

- **Type code (written on the top of the device/type label); and**
- **Version of the device model (can be found in menu [Device Parameters\Version].**

The *PowerPort-E* application also enables the User to create a configuration/parameter file off-line using a “Device Model”. The advantage of using a device model is that the User can pre-configure a device by setting parameters in advance.

The User can also read the parameter file out of the device, further process it off-line (e.g.: from the office) and finally re-transfer it to the device.

The User can either:

•Load an existing parameter file from a device (please refer to the Section “Loading Device Data When Using PowerPort-E");

•Create a new parameter file (see below); or

•Open a locally saved parameter file (backup).

In order to create a new device/parameter file by way of a device template off-line.

•In order to create a new off-line parameter file, select »Create new parameter file« within the »File« menu.

•A working window pops- up. Please make sure that you select the right device type with the correct version and configuration.

•Finally click on »Apply«.

•In order to save the device configuration, select »Save« out of the »File« menu.

•Within the »Modify Device Configuration (Typecode)« menu, the User can modify the device configuration or simply find out the type code of the current selection.

If the User wants to transfer the parameter file into a device, please refer to Section “Restoring Device Data When using PowerPort-E”.

Measuring Values

Read Out Measured Values

In the »Operation/Measured Values« menu, both measured and calculated values can be viewed. The measured values are ordered by »Standard values« and »Special values« (depending on the type of device).

Read Out of Measured Values Via PowerPort-E

- If *PowerPort-E* is not running, please start the application.
- If the device data have not been loaded, select »Receive Data From The Device« from the »Device« menu.
- Double click on the »Operation« icon in the navigation tree.
- Double click on the »Measured Values« icon within the »Operation« navigation tree.
- Double click the »Standard Values« or »Special values« within the »Measured values« tree.
- The measured and calculated values are now shown in tabular form in the window.

NOTICE **To have the measuring data read in a cyclic manner, select »Auto refresh« in the »View« menu. The measured values are read out about every two seconds.**

Standard Measured Values

W1 ,W2

Value	*Description*	*Menu Path*
Angle IA	Measured Value (Calculated): Angle of Phasor IA	[Operation /Measured Values /Currents W1]
Angle IB	Measured Value (Calculated): Angle of Phasor phi IB	[Operation /Measured Values /Currents W1]
Angle IC	Measured Value (Calculated): Angle of Phasor phi IC	[Operation /Measured Values /Currents W1]
Angle IG meas	Measured Value: Angle of Phasor IG meas	[Operation /Measured Values /Currents W1]
Angle IG calc	Measured Value (Calculated): Angle of Phasor IG calc	[Operation /Measured Values /Currents W1]
IA Fund.	Measured value: Phase current (Fundamental)	[Operation /Measured Values /Currents W1]
IB Fund.	Measured value: Phase current (Fundamental)	[Operation /Measured Values /Currents W1]
IC Fund.	Measured value: Phase current (Fundamental)	[Operation /Measured Values /Currents W1]
IX meas Fund.	Measured value (measured): IX (Fundamental)	[Operation /Measured Values /Currents W1]
IR calc Fund.	Measured value (calculated): IR (Fundamental)	[Operation /Measured Values /Currents W1]
I0 Fund.	Measured value (calculated): Zero current (Fundamental)	[Operation /Measured Values /Currents W1]
I1 Fund.	Measured value (calculated): Positive phase sequence current (Fundamental)	[Operation /Measured Values /Currents W1]

I2 Fund.	Measured value (calculated): Unbalanced load current (Fundamental)	[Operation /Measured Values /Currents W1]
IA H2	Measured Value: Ratio of 2nd harmonic over fundamental of IA	[Operation /Measured Values /Currents W1]
IB H2	Measured Value: Ratio of 2nd harmonic over fundamental of IB	[Operation /Measured Values /Currents W1]
IC H2	Measured Value: Ratio of 2nd harmonic over fundamental of IC	[Operation /Measured Values /Currents W1]
IG H2	Measured Value: Ratio of 2nd harmonic over fundamental of IG	[Operation /Measured Values /Currents W1]
IA RMS	Measured value: Phase current (RMS)	[Operation /Measured Values /Currents W1]
IB RMS	Measured value: Phase current (RMS)	[Operation /Measured Values /Currents W1]
IC RMS	Measured value: Phase current (RMS)	[Operation /Measured Values /Currents W1]
IX meas RMS	Measured value (measured): IX (RMS)	[Operation /Measured Values /Currents W1]
IR calc RMS	Measured value (calculated): IR (RMS)	[Operation /Measured Values /Currents W1]
%IA THD	Measured Value (Calculated): IA Total Harmonic Distortion	[Operation /Measured Values /Currents W1]
%IB THD	Measured Value (Calculated): IB Total Harmonic Distortion	[Operation /Measured Values /Currents W1]
%IC THD	Measured Value (Calculated): IC Total Harmonic Distortion	[Operation /Measured Values /Currents W1]

IA THD	Measured Value (Calculated): IA Total Harmonic Current	[Operation /Measured Values /Currents W1]
IB THD	Measured Value (Calculated): IB Total Harmonic Current	[Operation /Measured Values /Currents W1]
IC THD	Measured Value (Calculated): IC Total Harmonic Current	[Operation /Measured Values /Currents W1]

Statistics

Statistics

In the »Operation/Statistics« menu, the minimum, maximum, and mean values of the measured and calculated quantities can be found. The statistics are ordered by »Standard values« and »Special values« (depending on the type of device and the device planning).

In the »Device Parameter/Statistics« *menu, the User* can either set a fixed synchronization time and a calculation interval or start and stop the statistics via a function (e.g.: digital input).

Read Out Statistics

- Call up the main menu.
- Call up the »Operation/Statistics« sub-menu.
- Call up either the »Standard values« or »Special values«.

Statistics to Be Read Out Via PowerPort-E

- If PowerPort-E is not running, please start the application.
- If device data have not been downloaded recently, click »Receive Data From The Device« in the »Device« menu.
- Double click on the »Operation« icon in the navigation tree.
- Double click on the »Statistics« icon within the »Operation« navigation tree.
- Double click on the »Standard values« or »Special values« icon.
- In the window, the statistical data are shown in tabular form.

The values can be read out cyclically. For this purpose, please select »Auto Refresh« out of the »View« menu.

Statistics (Configuration)

The Statistics module can be configured within the »Device Parameter/Statistics« menu.

The time interval, that is taken into account for the calculation of the statistics, can either be limited by a fixed duration or it can be limited by a start function (freely assignable signal from the »assignment list« menu).

Fixed Duration:

If the statistics module is set to a fixed duration/time interval, the minimum, maximum, and average values will be calculated and displayed continuously on the basis of this duration/time interval.

Start Function (Flexible Duration):

If the statistics module is to be initiated by a start function, the statistics will not be updated until the start function becomes true (rising edge). At the same time, a new time interval will be started.

Statistics (Configuration) Via PowerPort-E

•If PowerPort-E is not running, please start the application.

•If device data have not been downloaded recently, click »Receive Data From The Device« in the»Device« menu.

•Double click on the »Device Parameter« icon in the navigation tree.

•Double click on the »Statistics« icon within the »Device Parameter« navagation tree.

•Configure the Statistics module.

Direct Commands

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Reset	Reset of statistics	Inactive, Active	Inactive	[Operation /Reset]

Standard Statistic Values

Value	*Description*	*Menu Path*
I1 max Fund.	Maximum value positive phase sequence current (Fundamental)	[Operation /Statistics /Currents W1]
I1 avg Fund.	Average value positive phase sequence current (Fundamental)	[Operation /Statistics /Currents W1]
I1 min Fund.	Minimum value positive phase sequence current (Fundamental)	[Operation /Statistics /Currents W1]
I2 max Fund.	Maximum value unbalanced load current (Fundamental)	[Operation /Statistics /Currents W1]
I2 avg Fund.	Average value unbalanced load current (Fundamental)	[Operation /Statistics /Currents W1]
I2 min Fund.	Minimum value unbalanced load current (Fundamental)	[Operation /Statistics /Currents W1]
IA H2 max	Maximum ratio of 2nd harmonic over fundamental of IA	[Operation /Statistics /Currents W1]
IA H2 avg	Average ratio of 2nd harmonic over fundamental of IA	[Operation /Statistics /Currents W1]
IA H2 min	Minimum ratio of 2nd harmonic over fundamental of IA	[Operation /Statistics /Currents W1]
IB H2 max	Maximum ratio of 2nd harmonic over fundamental of IB	[Operation /Statistics /Currents W1]

IB H2 avg	Average ratio of 2nd harmonic over fundamental of IB	[Operation /Statistics /Currents W1]
IB H2 min	Minimum ratio of 2nd harmonic over fundamental of IB	[Operation /Statistics /Currents W1]
IC H2 max	Maximum ratio of 2nd harmonic over fundamental of IC	[Operation /Statistics /Currents W1]
IC H2 avg	Average ratio of 2nd harmonic over fundamental of IC	[Operation /Statistics /Currents W1]
IC H2 min	Minimum ratio of 2nd harmonic over fundamental minimum value of IC	[Operation /Statistics /Currents W1]
IG H2 max	Maximum ratio of 2nd harmonic over fundamental of IG	[Operation /Statistics /Currents W1]
IG H2 avg	Average ratio of 2nd harmonic over fundamental of IG	[Operation /Statistics /Currents W1]
IG H2 min	Minimum ratio of 2nd harmonic over fundamental of IG	[Operation /Statistics /Currents W1]
IA max RMS	IA maximum value (RMS)	[Operation /Statistics /Currents W1]
IA avg RMS	IA average value (RMS)	[Operation /Statistics /Currents W1]
IA min RMS	IA minimum value (RMS)	[Operation /Statistics /Currents W1]
IB max RMS	IB maximum value (RMS)	[Operation /Statistics /Currents W1]
IB avg RMS	IB average value (RMS)	[Operation /Statistics /Currents W1]

IB min RMS	IB minimum value (RMS)	[Operation /Statistics /Currents W1]
IC max RMS	IC maximum value (RMS)	[Operation /Statistics /Currents W1]
IC avg RMS	IC average value (RMS)	[Operation /Statistics /Currents W1]
IC min RMS	IC minimum value (RMS)	[Operation /Statistics /Currents W1]
%IA THD max	IATotal Harmonic Distortion maximum value / fundamental	[Operation /Statistics /Currents W1]
%IB THD max	IBTotal Harmonic Distortion maximum value / fundamental	[Operation /Statistics /Currents W1]
%IC THD max	ICTotal Harmonic Distortion maximum value / fundamental	[Operation /Statistics /Currents W1]
IA THD max	IA Total Harmonic Current maximum value	[Operation /Statistics /Currents W1]
IB THD max	IB Total Harmonic Current maximum value	[Operation /Statistics /Currents W1]
IC THD max	IC Total Harmonic Current maximum value	[Operation /Statistics /Currents W1]
Value	*Description*	*Menu Path*
IrA	Measured Value (Calculated): Restraint Current Phase A	[Operation /Measured Values /87]
IrB	Measured Value (Calculated): Restraint Current Phase B	[Operation /Measured Values /87]
IrC	Measured Value (Calculated): Restraint Current Phase C	[Operation /Measured Values /87]

Value	*Description*	*Menu Path*
IdA	Measured Value (Calculated): Differential Current Phase A	[Operation /Measured Values /87]
IdB	Measured Value (Calculated): Differential Current Phase B	[Operation /Measured Values /87]
IdC	Measured Value (Calculated): Differential Current Phase C	[Operation /Measured Values /87]
IrG W1	Measured Value (Calculated): Ground Restraint Current Winding 1	[Operation /Measured Values /87GD W1]
IdG W1	Measured Value (Calculated): Ground Differential Current Winding 1	[Operation /Measured Values /87GD W1]
IrG W2	Measured Value (Calculated): Ground Restraint Current Winding 2	[Operation /Measured Values /87GD W2]
IdG W2	Measured Value (Calculated): Ground Differential Current Winding 2	[Operation /Measured Values /87GD W2]

Global Protection Parameters of the Statistics Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Start via:	Start statistics by:	Duration, StartFct	StartFct	[Device Para /Statistics]
StartFct	Update the displayed statistics and start new measuring interval if the assigned signal becomes true (rising edge): Only available if: Start via: = StartFct	1..n, Assignment List	-.-	[Device Para /Statistics]
ResetFct	Reset of statistics if the assigned signal becomes true (slope).	1..n, Assignment List	-.-	[Device Para /Statistics]
Duration	Recording time Only available if: Start via: = Duration	15 s, 30 s, 1 min, 10 min, 30 min, 1 h, 2 h, 6 h, 12 h, 1 d, 2 d, 5 d, 7 d, 10 d, 30 d	15 s	[Device Para /Statistics]

States of the Inputs of the Statistics Module

Name	*Description*	*Assignment Via*
StartFct-I	Module input state: Start statistics Module input signal	[Device Para /Statistics]
ResetFct-I	Module Input State: Reset Statistics Module input signal	[Device Para /Statistics]

Signals of the Statistics Module

Name	*Description*
Reset	Signal: Reset of Statistics

Counters of the Module Statistics

Value	*Description*	*Menu Path*
MeasPointNo	Each measuring point that is taken over by the statistics increments this counter. By means of this counter, the User can check whether the statistics are alive and if data are being acquired.	[Operation /Count and RevData /Statistics]

Resets

Collective Acknowledgments for Latched Signals:

Collective Acknowledgments					
	LEDs	*Relay Outputs*	*SCADA*	*Pending Trip Command*	*LEDs+ Relay Outputs+ SCADA+ Pending Trip Command*
Via **PowerPort-E** or at the ***panel all...*** can be acknowledged. At the panel, the [Operation\ Acknowledge] menu can directly be accessed via the **»C«** key.	All LEDs at once: Where? [Operation\ Acknowledge]	All Relay Outputs at once: Where? [Operation\ Acknowledge]	All SCADA signals at once: Where? [Operation\ Acknowledge]	All pending trip commands at once: Where? [Operation\ Acknowledge]	All at once: Where? [Operation\ Acknowledge]
External Acknowledgment: Via a signal from the assignment list (e.g.: a digital Input) ***all***... can be acknowledged.	All LEDs at once: Where? Within the *Ex Acknowledge menu.*	All Relay Outputs at once: *Where?* *Within the Ex Acknowledge menu.*	All SCADA signals at once: *Where?* *Within the Ex Acknowledge menu.*	All Pending Trip commands at once: *Where?* *Within the Ex Acknowledge menu.*	All at once: *Where?* *Within the Ex Acknowledge menu.*

Options for Individual Acknowledgments for Latched Signals:

Individual Acknowledgment			
	LEDs	*Relay Output*	*Pending Trip Command*
Via a signal from the assignment list (e.g.: a digital Input), a ***single***... can be acknowledged.	Single LED: Where? Within the Configuration menu of this single LED.	Relay Output: Where? Within the Configuration menu of this single Relay Output.	Pending Trip Command. Where? Within the module *TripControl*

NOTICE **If the User is within the parameter setting mode, the User cannot acknowledge.**

NOTICE **In case of a fault during parameter setting via the operating panel, the User must first leave the parameter mode by pressing either push-button »C« or »OK« before accessing the »Acknowledgements« menu via the push-button.**

Manual Acknowledgment

•Press the »C« button on the panel.

•Select the item to be acknowledged via the Softkeys:

- Relay Outputs;
- LEDs;
- SCADA;
- A trip command; or
- All the above mentioned items at once.

•Press the Softkey with the »Wrench-Symbol«.

•Enter the password.

Manual Acknowledgment Via PowerPort-E

- If PowerPort-E is not running, please start the application.
- If device data have not been downloaded recently, select »Receive Data From The Device« from the »Device« menu.
- Double click on the »Operation« icon in the navigation tree.
- Double click on the »Acknowledgment« icon within the operation menu.
- Double click the entry within the pop-up that is to be acknowledged.
- Press the »Execute immediately« button.
- Enter the password.

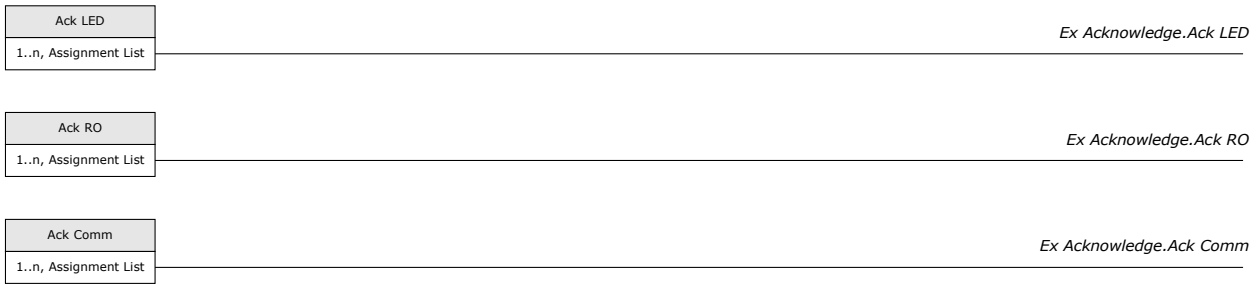
External Acknowledgments

Within the [Ex Acknowledge] menu, the User can assign a signal (e.g.: the state of a digital input) from the assignment list that:

•Acknowledges all (acknowledgeable) LEDs at once;

•Acknowledges all (acknowledgeable) Output Relays at once; or

•Acknowledges all (acknowledgeable) SCADA signals at once.



Within the [Protection Para\Global Prot Para\TripControl] menu, the User can assign a signal that acknowledges a pending trip command.

For details, please refer to the Trip Control *section*.

External Acknowledge Via PowerPort-E

•If PowerPort-E *view* is not running, please start the application.

•If device data have not been downloaded recently, select »Receive Data From The Device« from the »Device« menu.

•Double click on the »Device Parameter« icon in the navigation tree.

•Double click on the »Ex Acknowledge« icon within the operation menu.

•In the working window, the User can now assign each signal that resets all acknowledgeable LEDs, a signal that resets all Relay Outputs, a signal that resets the SCADA signals respectively, and a signal that acknowledges a pending trip command.

External LED-Acknowledgement Signals

The following signals can be used for external acknowledgement of latched LEDs.

Name	*Description*
-.-	No assignment
DI Slot X1.DI 1	Signal: Digital Input
DI Slot X1.DI 2	Signal: Digital Input
DI Slot X1.DI 3	Signal: Digital Input
DI Slot X1.DI 4	Signal: Digital Input
DI Slot X1.DI 5	Signal: Digital Input
DI Slot X1.DI 6	Signal: Digital Input
DI Slot X1.DI 7	Signal: Digital Input
DI Slot X1.DI 8	Signal: Digital Input
Modbus.Comm Cmd 1	Communication Command
Modbus.Comm Cmd 2	Communication Command
Modbus.Comm Cmd 3	Communication Command
Modbus.Comm Cmd 4	Communication Command
Modbus.Comm Cmd 5	Communication Command
Modbus.Comm Cmd 6	Communication Command
Modbus.Comm Cmd 7	Communication Command
Modbus.Comm Cmd 8	Communication Command
Modbus.Comm Cmd 9	Communication Command
Modbus.Comm Cmd 10	Communication Command
Modbus.Comm Cmd 11	Communication Command
Modbus.Comm Cmd 12	Communication Command
Modbus.Comm Cmd 13	Communication Command
Modbus.Comm Cmd 14	Communication Command
Modbus.Comm Cmd 15	Communication Command
Modbus.Comm Cmd 16	Communication Command

Manual Resets

In the *»Operation/Reset« menu, the User* can:

•Reset counters;

•Delete records (e.g.: disturbance records); and

•Reset special things (like statistics, thermal replica, etc.).

NOTICE **The description of the reset commands can be found within the corresponding modules.**

Manual Resets Via PowerPort-E

•If PowerPort-E is not running, please start the application.

•If device data have not been downloaded recently, click »Receive Data From The Device« in the »Device« menu.

•Double click the »Operation« icon in the navigation tree.

•Double click the »Reset icon« within the operation menu.

•Double click the entry within the pop-up that is to be reset or deleted.

NOTICE **The description of the reset commands can be found within the corresponding modules.**

Assignment List

The »ASSIGNMENT LIST« below summarizes all module outputs (signals) and inputs (e.g.: states of the assignments).

Name	*Description*
-.-	No assignment
Prot.Available	Signal: Protection is available.
Prot.Active	Signal: Active
Prot.ExBlo	Signal: External Blocking
Prot.Pickup Phase A	Signal: General Pickup Phase A
Prot.Pickup Phase B	Signal: General Pickup Phase B
Prot.Pickup Phase C	Signal: General Pickup Phase C
Prot.Pickup IX or IR	Signal: General Pickup - Ground Fault
Prot.Pickup	Signal: General Pickup
Prot.Trip Phase A	Signal: General Trip Phase A
Prot.Trip Phase B	Signal: General Trip Phase B
Prot.Trip Phase C	Signal: General Trip Phase C
Prot.Trip IX or IR	Signal: General Trip Ground Fault
Prot.Trip	Signal: General Trip
Prot.Res Fault a Mains No	Signal: Resetting of fault number and number of grid faults.
Prot.ExBlo1-I	Module Input State: External Blocking1
Prot.ExBlo2-I	Module Input State: External Blocking2
Bkr[1].TripCmd	Signal: Trip Command
Bkr[1].Ack TripCmd	Signal: Acknowledge Trip Command
Bkr[1].Ready	Signal: Breaker is ready for operation.
Bkr[1].Manual OPEN	Signal: Breaker was switched off manually.
Bkr[1].Manual CLOSE	Signal: Breaker was switched on manually.
Bkr[1].Pos OPEN	Signal: Breaker is in OPEN-Position
Bkr[1].Pos CLOSE	Signal: Breaker is in CLOSE-Position
Bkr[1].Pos Indeterm	Signal: Breaker is in Indeterminate Position
Bkr[1].Pos Disturb	Signal: Breaker Disturbed - Undefined Breaker Position. The Position Indicators contradict themselves. After expiring of a supervision timer this signal becomes true.
Bkr[1].Acknow Sig-I	Module Input State: Acknowledgment Signal (only for automatic acknowledgment). Module input signal
Bkr[1].CinBkr-52a-I	Position indicator/check-back signal of the Bkr (52a)
Bkr[1].CinBkr-52b-I	Module Input State: Position indicator/check-back signal of the Bkr. (52b)
Bkr[1].Manual CLOSE-I	Module Input State: Breaker was switched on manually.
Bkr[1].Manual OPEN-I	Module Input State: Breaker was switched off (OPEN) manually.
Bkr[1].Ready-I	Module Input State: Breaker Ready
Bkr[2].TripCmd	Signal: Trip Command
Bkr[2].Ack TripCmd	Signal: Acknowledge Trip Command
Bkr[2].Ready	Signal: Breaker is ready for operation.

Name	*Description*
Bkr[2].Manual OPEN	Signal: Breaker was switched off manually.
Bkr[2].Manual CLOSE	Signal: Breaker was switched on manually.
Bkr[2].Pos OPEN	Signal: Breaker is in OPEN-Position
Bkr[2].Pos CLOSE	Signal: Breaker is in CLOSE-Position
Bkr[2].Pos Indeterm	Signal: Breaker is in Indeterminate Position
Bkr[2].Pos Disturb	Signal: Breaker Disturbed - Undefined Breaker Position. The Position Indicators contradict themselves. After expiring of a supervision timer this signal becomes true.
Bkr[2].Acknow Sig-I	Module Input State: Acknowledgment Signal (only for automatic acknowledgment). Module input signal
Bkr[2].CinBkr-52a-I	Position indicator/check-back signal of the Bkr (52a)
Bkr[2].CinBkr-52b-I	Module Input State: Position indicator/check-back signal of the Bkr. (52b)
Bkr[2].Manual CLOSE-I	Module Input State: Breaker was switched on manually.
Bkr[2].Manual OPEN-I	Module Input State: Breaker was switched off (OPEN) manually.
Bkr[2].Ready-I	Module Input State: Breaker Ready
BWear[1].Active	Signal: Active
BWear[1].ExBlo	Signal: External Blocking
BWear[1].Operations Alarm	Signal: Service Alarm, too many Operations
BWear[1].Isum Intr trip: IA	Signal: Maximum permissible Summation of the interruppting (tripping) currents exceeded: IA
BWear[1].Isum Intr trip: IB	Signal: Maximum permissible Summation of the interruppting (tripping) currents exceeded: IB
BWear[1].Isum Intr trip: IC	Signal: Maximum permissible Summation of the interruppting (tripping) currents exceeded: IC
BWear[1].Isum Intr trip	Signal: Maximum permissible Summation of the interruppting (tripping) currents exceeded in at least one phase.
BWear[1].Res TripCmdCr	Signal: Resetting of the Counter: total number of trip commands
BWear[1].Res Isum trip	Signal: Reset summation of the tripping currents
BWear[1].ExBlo1-I	Module Input State: External Blocking1
BWear[1].ExBlo2-I	Module Input State: External Blocking2
BWear[2].Active	Signal: Active
BWear[2].ExBlo	Signal: External Blocking
BWear[2].Operations Alarm	Signal: Service Alarm, too many Operations
BWear[2].Isum Intr trip: IA	Signal: Maximum permissible Summation of the interruppting (tripping) currents exceeded: IA
BWear[2].Isum Intr trip: IB	Signal: Maximum permissible Summation of the interruppting (tripping) currents exceeded: IB
BWear[2].Isum Intr trip: IC	Signal: Maximum permissible Summation of the interruppting (tripping) currents exceeded: IC
BWear[2].Isum Intr trip	Signal: Maximum permissible Summation of the interruppting (tripping) currents exceeded in at least one phase.
BWear[2].Res TripCmdCr	Signal: Resetting of the Counter: total number of trip commands
BWear[2].Res Isum trip	Signal: Reset summation of the tripping currents
BWear[2].ExBlo1-I	Module Input State: External Blocking1
BWear[2].ExBlo2-I	Module Input State: External Blocking2

Name	*Description*
87.Active	Signal: Active
87.ExBlo	Signal: External Blocking
87.Blo TripCmd	Signal: Trip Command blocked
87.ExBlo TripCmd	Signal: External Blocking of the Trip Command
87.Alarm A	Signal: Pickup System Phase A
87.Alarm B	Signal: Pickup System Phase B
87.Alarm C	Signal: Pickup System C
87.Pickup	Signal: Pickup
87.Trip A	Signal: Trip System Phase A
87.Trip B	Signal: Trip System Phase B
87.Trip C	Signal: Trip System Phase C
87.Trip	Signal: Trip
87.TripCmd	Signal: Trip Command
87.Blo H2	Signal: Blocked by Harmonic:2
87.Blo H4	Signal: Blocked by Harmonic:4
87.Blo H5	Signal: Blocked by Harmonic:5
87.H2,H4,H5 Blo	Signal: Blocked by Harmonics (Inhibit)
87.Slope Blo	Signal: Differential Protection was blocked by Current Transformer Supervision (Inhibit).
87.Transient	Signal: Temporary restraining of the differential protection afterwards the transformer is beeing engergized.
87.Restraining	Signal: Restraining of the differential protection by means of rising the tripping curve.
87.ExBlo1-I	Module Input State: External Blocking1
87.ExBlo2-I	Module Input State: External Blocking2
87.ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
87H.Active	Signal: Active
87H.ExBlo	Signal: External Blocking
87H.Blo TripCmd	Signal: Trip Command blocked
87H.ExBlo TripCmd	Signal: External Blocking of the Trip Command
87H.Alarm A	Signal: Pickup System Phase A
87H.Alarm B	Signal: Pickup System Phase B
87H.Alarm C	Signal: Pickup System C
87H.Pickup	Signal: Pickup
87H.Trip A	Signal: Trip System Phase A
87H.Trip B	Signal: Trip System Phase B
87H.Trip C	Signal: Trip System Phase C
87H.Trip	Signal: Trip
87H.TripCmd	Signal: Trip Command
87H.ExBlo1-I	Module Input State: External Blocking1
87H.ExBlo2-I	Module Input State: External Blocking2
87H.ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command

Name	*Description*
87GD[1].Active	Signal: Active
87GD[1].ExBlo	Signal: External Blocking
87GD[1].Blo TripCmd	Signal: Trip Command blocked
87GD[1].ExBlo TripCmd	Signal: External Blocking of the Trip Command
87GD[1].Pickup	Signal: Pickup
87GD[1].Trip	Signal: Trip
87GD[1].TripCmd	Signal: Trip Command
87GD[1].ExBlo1-I	Module Input State: External Blocking1
87GD[1].ExBlo2-I	Module Input State: External Blocking2
87GD[1].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
87GDH[1].Active	Signal: Active
87GDH[1].ExBlo	Signal: External Blocking
87GDH[1].Blo TripCmd	Signal: Trip Command blocked
87GDH[1].ExBlo TripCmd	Signal: External Blocking of the Trip Command
87GDH[1].Pickup	Signal: Pickup
87GDH[1].Trip	Signal: Trip
87GDH[1].TripCmd	Signal: Trip Command
87GDH[1].ExBlo1-I	Module Input State: External Blocking1
87GDH[1].ExBlo2-I	Module Input State: External Blocking2
87GDH[1].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
87GD[2].Active	Signal: Active
87GD[2].ExBlo	Signal: External Blocking
87GD[2].Blo TripCmd	Signal: Trip Command blocked
87GD[2].ExBlo TripCmd	Signal: External Blocking of the Trip Command
87GD[2].Pickup	Signal: Pickup
87GD[2].Trip	Signal: Trip
87GD[2].TripCmd	Signal: Trip Command
87GD[2].ExBlo1-I	Module Input State: External Blocking1
87GD[2].ExBlo2-I	Module Input State: External Blocking2
87GD[2].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
87GDH[2].Active	Signal: Active
87GDH[2].ExBlo	Signal: External Blocking
87GDH[2].Blo TripCmd	Signal: Trip Command blocked
87GDH[2].ExBlo TripCmd	Signal: External Blocking of the Trip Command
87GDH[2].Pickup	Signal: Pickup
87GDH[2].Trip	Signal: Trip
87GDH[2].TripCmd	Signal: Trip Command
87GDH[2].ExBlo1-I	Module Input State: External Blocking1
87GDH[2].ExBlo2-I	Module Input State: External Blocking2
87GDH[2].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
50P[1].Active	Signal: Active

Name	*Description*
50P[1].ExBlo	Signal: External Blocking
50P[1].Rvs Blo	Signal: Reverse Blocking
50P[1].Blo TripCmd	Signal: Trip Command blocked
50P[1].ExBlo TripCmd	Signal: External Blocking of the Trip Command
50P[1].IH2 Blo	Signal: Blocking the trip command by IH2
50P[1].Pickup IA	Signal: Pickup IA
50P[1].Pickup IB	Signal: Pickup IB
50P[1].Pickup IC	Signal: Pickup IC
50P[1].Pickup	Signal: Pickup
50P[1].Trip IA	Signal: Trip IA
50P[1].Trip IB	Signal: Trip IB
50P[1].Trip IC	Signal: Trip IC
50P[1].Trip	Signal: Trip
50P[1].TripCmd	Signal: Trip Command
50P[1].DefaultSet	Signal: Default Parameter Set
50P[1].AdaptSet 1	Signal: Adaptive Parameter 1
50P[1].AdaptSet 2	Signal: Adaptive Parameter 2
50P[1].AdaptSet 3	Signal: Adaptive Parameter 3
50P[1].AdaptSet 4	Signal: Adaptive Parameter 4
50P[1].ExBlo1-I	Module Input State: External Blocking1
50P[1].ExBlo2-I	Module Input State: External Blocking2
50P[1].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
50P[1].Rvs Blo-I	Module Input State: Reverse Blocking
50P[1].AdaptSet1-I	Module Input State: Adaptive Parameter1
50P[1].AdaptSet2-I	Module Input State: Adaptive Parameter2
50P[1].AdaptSet3-I	Module Input State: Adaptive Parameter3
50P[1].AdaptSet4-I	Module Input State: Adaptive Parameter4
50P[2].Active	Signal: Active
50P[2].ExBlo	Signal: External Blocking
50P[2].Rvs Blo	Signal: Reverse Blocking
50P[2].Blo TripCmd	Signal: Trip Command blocked
50P[2].ExBlo TripCmd	Signal: External Blocking of the Trip Command
50P[2].IH2 Blo	Signal: Blocking the trip command by IH2
50P[2].Pickup IA	Signal: Pickup IA
50P[2].Pickup IB	Signal: Pickup IB
50P[2].Pickup IC	Signal: Pickup IC
50P[2].Pickup	Signal: Pickup
50P[2].Trip IA	Signal: Trip IA
50P[2].Trip IB	Signal: Trip IB
50P[2].Trip IC	Signal: Trip IC
50P[2].Trip	Signal: Trip

Name	*Description*
50P[2].TripCmd	Signal: Trip Command
50P[2].DefaultSet	Signal: Default Parameter Set
50P[2].AdaptSet 1	Signal: Adaptive Parameter 1
50P[2].AdaptSet 2	Signal: Adaptive Parameter 2
50P[2].AdaptSet 3	Signal: Adaptive Parameter 3
50P[2].AdaptSet 4	Signal: Adaptive Parameter 4
50P[2].ExBlo1-I	Module Input State: External Blocking1
50P[2].ExBlo2-I	Module Input State: External Blocking2
50P[2].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
50P[2].Rvs Blo-I	Module Input State: Reverse Blocking
50P[2].AdaptSet1-I	Module Input State: Adaptive Parameter1
50P[2].AdaptSet2-I	Module Input State: Adaptive Parameter2
50P[2].AdaptSet3-I	Module Input State: Adaptive Parameter3
50P[2].AdaptSet4-I	Module Input State: Adaptive Parameter4
50P[3].Active	Signal: Active
50P[3].ExBlo	Signal: External Blocking
50P[3].Rvs Blo	Signal: Reverse Blocking
50P[3].Blo TripCmd	Signal: Trip Command blocked
50P[3].ExBlo TripCmd	Signal: External Blocking of the Trip Command
50P[3].IH2 Blo	Signal: Blocking the trip command by IH2
50P[3].Pickup IA	Signal: Pickup IA
50P[3].Pickup IB	Signal: Pickup IB
50P[3].Pickup IC	Signal: Pickup IC
50P[3].Pickup	Signal: Pickup
50P[3].Trip IA	Signal: Trip IA
50P[3].Trip IB	Signal: Trip IB
50P[3].Trip IC	Signal: Trip IC
50P[3].Trip	Signal: Trip
50P[3].TripCmd	Signal: Trip Command
50P[3].DefaultSet	Signal: Default Parameter Set
50P[3].AdaptSet 1	Signal: Adaptive Parameter 1
50P[3].AdaptSet 2	Signal: Adaptive Parameter 2
50P[3].AdaptSet 3	Signal: Adaptive Parameter 3
50P[3].AdaptSet 4	Signal: Adaptive Parameter 4
50P[3].ExBlo1-I	Module Input State: External Blocking1
50P[3].ExBlo2-I	Module Input State: External Blocking2
50P[3].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
50P[3].Rvs Blo-I	Module Input State: Reverse Blocking
50P[3].AdaptSet1-I	Module Input State: Adaptive Parameter1
50P[3].AdaptSet2-I	Module Input State: Adaptive Parameter2
50P[3].AdaptSet3-I	Module Input State: Adaptive Parameter3

Name	*Description*
50P[3].AdaptSet4-I	Module Input State: Adaptive Parameter4
50P[4].Active	Signal: Active
50P[4].ExBlo	Signal: External Blocking
50P[4].Rvs Blo	Signal: Reverse Blocking
50P[4].Blo TripCmd	Signal: Trip Command blocked
50P[4].ExBlo TripCmd	Signal: External Blocking of the Trip Command
50P[4].IH2 Blo	Signal: Blocking the trip command by IH2
50P[4].Pickup IA	Signal: Pickup IA
50P[4].Pickup IB	Signal: Pickup IB
50P[4].Pickup IC	Signal: Pickup IC
50P[4].Pickup	Signal: Pickup
50P[4].Trip IA	Signal: Trip IA
50P[4].Trip IB	Signal: Trip IB
50P[4].Trip IC	Signal: Trip IC
50P[4].Trip	Signal: Trip
50P[4].TripCmd	Signal: Trip Command
50P[4].DefaultSet	Signal: Default Parameter Set
50P[4].AdaptSet 1	Signal: Adaptive Parameter 1
50P[4].AdaptSet 2	Signal: Adaptive Parameter 2
50P[4].AdaptSet 3	Signal: Adaptive Parameter 3
50P[4].AdaptSet 4	Signal: Adaptive Parameter 4
50P[4].ExBlo1-I	Module Input State: External Blocking1
50P[4].ExBlo2-I	Module Input State: External Blocking2
50P[4].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
50P[4].Rvs Blo-I	Module Input State: Reverse Blocking
50P[4].AdaptSet1-I	Module Input State: Adaptive Parameter1
50P[4].AdaptSet2-I	Module Input State: Adaptive Parameter2
50P[4].AdaptSet3-I	Module Input State: Adaptive Parameter3
50P[4].AdaptSet4-I	Module Input State: Adaptive Parameter4
51P[1].Active	Signal: Active
51P[1].ExBlo	Signal: External Blocking
51P[1].Rvs Blo	Signal: Reverse Blocking
51P[1].Blo TripCmd	Signal: Trip Command blocked
51P[1].ExBlo TripCmd	Signal: External Blocking of the Trip Command
51P[1].IH2 Blo	Signal: Blocking the trip command by IH2
51P[1].Pickup IA	Signal: Pickup IA
51P[1].Pickup IB	Signal: Pickup IB
51P[1].Pickup IC	Signal: Pickup IC
51P[1].Pickup	Signal: Pickup
51P[1].Trip IA	Signal: Trip IA
51P[1].Trip IB	Signal: Trip IB

Name	*Description*
51P[1].Trip IC	Signal: Trip IC
51P[1].Trip	Signal: Trip
51P[1].TripCmd	Signal: Trip Command
51P[1].DefaultSet	Signal: Default Parameter Set
51P[1].AdaptSet 1	Signal: Adaptive Parameter 1
51P[1].AdaptSet 2	Signal: Adaptive Parameter 2
51P[1].AdaptSet 3	Signal: Adaptive Parameter 3
51P[1].AdaptSet 4	Signal: Adaptive Parameter 4
51P[1].ExBlo1-I	Module Input State: External Blocking1
51P[1].ExBlo2-I	Module Input State: External Blocking2
51P[1].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
51P[1].Rvs Blo-I	Module Input State: Reverse Blocking
51P[1].AdaptSet1-I	Module Input State: Adaptive Parameter1
51P[1].AdaptSet2-I	Module Input State: Adaptive Parameter2
51P[1].AdaptSet3-I	Module Input State: Adaptive Parameter3
51P[1].AdaptSet4-I	Module Input State: Adaptive Parameter4
51P[2].Active	Signal: Active
51P[2].ExBlo	Signal: External Blocking
51P[2].Rvs Blo	Signal: Reverse Blocking
51P[2].Blo TripCmd	Signal: Trip Command blocked
51P[2].ExBlo TripCmd	Signal: External Blocking of the Trip Command
51P[2].IH2 Blo	Signal: Blocking the trip command by IH2
51P[2].Pickup IA	Signal: Pickup IA
51P[2].Pickup IB	Signal: Pickup IB
51P[2].Pickup IC	Signal: Pickup IC
51P[2].Pickup	Signal: Pickup
51P[2].Trip IA	Signal: Trip IA
51P[2].Trip IB	Signal: Trip IB
51P[2].Trip IC	Signal: Trip IC
51P[2].Trip	Signal: Trip
51P[2].TripCmd	Signal: Trip Command
51P[2].DefaultSet	Signal: Default Parameter Set
51P[2].AdaptSet 1	Signal: Adaptive Parameter 1
51P[2].AdaptSet 2	Signal: Adaptive Parameter 2
51P[2].AdaptSet 3	Signal: Adaptive Parameter 3
51P[2].AdaptSet 4	Signal: Adaptive Parameter 4
51P[2].ExBlo1-I	Module Input State: External Blocking1
51P[2].ExBlo2-I	Module Input State: External Blocking2
51P[2].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
51P[2].Rvs Blo-I	Module Input State: Reverse Blocking
51P[2].AdaptSet1-I	Module Input State: Adaptive Parameter1

Name	*Description*
51P[2].AdaptSet2-I	Module Input State: Adaptive Parameter2
51P[2].AdaptSet3-I	Module Input State: Adaptive Parameter3
51P[2].AdaptSet4-I	Module Input State: Adaptive Parameter4
51P[3].Active	Signal: Active
51P[3].ExBlo	Signal: External Blocking
51P[3].Rvs Blo	Signal: Reverse Blocking
51P[3].Blo TripCmd	Signal: Trip Command blocked
51P[3].ExBlo TripCmd	Signal: External Blocking of the Trip Command
51P[3].IH2 Blo	Signal: Blocking the trip command by IH2
51P[3].Pickup IA	Signal: Pickup IA
51P[3].Pickup IB	Signal: Pickup IB
51P[3].Pickup IC	Signal: Pickup IC
51P[3].Pickup	Signal: Pickup
51P[3].Trip IA	Signal: Trip IA
51P[3].Trip IB	Signal: Trip IB
51P[3].Trip IC	Signal: Trip IC
51P[3].Trip	Signal: Trip
51P[3].TripCmd	Signal: Trip Command
51P[3].DefaultSet	Signal: Default Parameter Set
51P[3].AdaptSet 1	Signal: Adaptive Parameter 1
51P[3].AdaptSet 2	Signal: Adaptive Parameter 2
51P[3].AdaptSet 3	Signal: Adaptive Parameter 3
51P[3].AdaptSet 4	Signal: Adaptive Parameter 4
51P[3].ExBlo1-I	Module Input State: External Blocking1
51P[3].ExBlo2-I	Module Input State: External Blocking2
51P[3].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
51P[3].Rvs Blo-I	Module Input State: Reverse Blocking
51P[3].AdaptSet1-I	Module Input State: Adaptive Parameter1
51P[3].AdaptSet2-I	Module Input State: Adaptive Parameter2
51P[3].AdaptSet3-I	Module Input State: Adaptive Parameter3
51P[3].AdaptSet4-I	Module Input State: Adaptive Parameter4
51P[4].Active	Signal: Active
51P[4].ExBlo	Signal: External Blocking
51P[4].Rvs Blo	Signal: Reverse Blocking
51P[4].Blo TripCmd	Signal: Trip Command blocked
51P[4].ExBlo TripCmd	Signal: External Blocking of the Trip Command
51P[4].IH2 Blo	Signal: Blocking the trip command by IH2
51P[4].Pickup IA	Signal: Pickup IA
51P[4].Pickup IB	Signal: Pickup IB
51P[4].Pickup IC	Signal: Pickup IC
51P[4].Pickup	Signal: Pickup

Name	*Description*
51P[4].Trip IA	Signal: Trip IA
51P[4].Trip IB	Signal: Trip IB
51P[4].Trip IC	Signal: Trip IC
51P[4].Trip	Signal: Trip
51P[4].TripCmd	Signal: Trip Command
51P[4].DefaultSet	Signal: Default Parameter Set
51P[4].AdaptSet 1	Signal: Adaptive Parameter 1
51P[4].AdaptSet 2	Signal: Adaptive Parameter 2
51P[4].AdaptSet 3	Signal: Adaptive Parameter 3
51P[4].AdaptSet 4	Signal: Adaptive Parameter 4
51P[4].ExBlo1-I	Module Input State: External Blocking1
51P[4].ExBlo2-I	Module Input State: External Blocking2
51P[4].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
51P[4].Rvs Blo-I	Module Input State: Reverse Blocking
51P[4].AdaptSet1-I	Module Input State: Adaptive Parameter1
51P[4].AdaptSet2-I	Module Input State: Adaptive Parameter2
51P[4].AdaptSet3-I	Module Input State: Adaptive Parameter3
51P[4].AdaptSet4-I	Module Input State: Adaptive Parameter4
50X[1].Active	Signal: Active
50X[1].ExBlo	Signal: External Blocking
50X[1].Rvs Blo	Signal: Reverse Blocking
50X[1].Blo TripCmd	Signal: Trip Command blocked
50X[1].ExBlo TripCmd	Signal: External Blocking of the Trip Command
50X[1].Pickup	Signal: Pickup IX or IR
50X[1].Trip	Signal: Trip
50X[1].TripCmd	Signal: Trip Command
50X[1].IGH2 Blo	Signal: Blocked by IH2
50X[1].DefaultSet	Signal: Default Parameter Set
50X[1].AdaptSet 1	Signal: Adaptive Parameter 1
50X[1].AdaptSet 2	Signal: Adaptive Parameter 2
50X[1].AdaptSet 3	Signal: Adaptive Parameter 3
50X[1].AdaptSet 4	Signal: Adaptive Parameter 4
50X[1].ExBlo1-I	Module Input State: External Blocking1
50X[1].ExBlo2-I	Module Input State: External Blocking2
50X[1].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
50X[1].Rvs Blo-I	Module Input State: Reverse Blocking
50X[1].AdaptSet1-I	Module Input State: Adaptive Parameter1
50X[1].AdaptSet2-I	Module Input State: Adaptive Parameter2
50X[1].AdaptSet3-I	Module Input State: Adaptive Parameter3
50X[1].AdaptSet4-I	Module Input State: Adaptive Parameter4
50X[2].Active	Signal: Active

Name	*Description*
50X[2].ExBlo	Signal: External Blocking
50X[2].Rvs Blo	Signal: Reverse Blocking
50X[2].Blo TripCmd	Signal: Trip Command blocked
50X[2].ExBlo TripCmd	Signal: External Blocking of the Trip Command
50X[2].Pickup	Signal: Pickup IX or IR
50X[2].Trip	Signal: Trip
50X[2].TripCmd	Signal: Trip Command
50X[2].IGH2 Blo	Signal: Blocked by IH2
50X[2].DefaultSet	Signal: Default Parameter Set
50X[2].AdaptSet 1	Signal: Adaptive Parameter 1
50X[2].AdaptSet 2	Signal: Adaptive Parameter 2
50X[2].AdaptSet 3	Signal: Adaptive Parameter 3
50X[2].AdaptSet 4	Signal: Adaptive Parameter 4
50X[2].ExBlo1-I	Module Input State: External Blocking1
50X[2].ExBlo2-I	Module Input State: External Blocking2
50X[2].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
50X[2].Rvs Blo-I	Module Input State: Reverse Blocking
50X[2].AdaptSet1-I	Module Input State: Adaptive Parameter1
50X[2].AdaptSet2-I	Module Input State: Adaptive Parameter2
50X[2].AdaptSet3-I	Module Input State: Adaptive Parameter3
50X[2].AdaptSet4-I	Module Input State: Adaptive Parameter4
51X[1].Active	Signal: Active
51X[1].ExBlo	Signal: External Blocking
51X[1].Rvs Blo	Signal: Reverse Blocking
51X[1].Blo TripCmd	Signal: Trip Command blocked
51X[1].ExBlo TripCmd	Signal: External Blocking of the Trip Command
51X[1].Pickup	Signal: Pickup IX or IR
51X[1].Trip	Signal: Trip
51X[1].TripCmd	Signal: Trip Command
51X[1].IGH2 Blo	Signal: Blocked by IH2
51X[1].DefaultSet	Signal: Default Parameter Set
51X[1].AdaptSet 1	Signal: Adaptive Parameter 1
51X[1].AdaptSet 2	Signal: Adaptive Parameter 2
51X[1].AdaptSet 3	Signal: Adaptive Parameter 3
51X[1].AdaptSet 4	Signal: Adaptive Parameter 4
51X[1].ExBlo1-I	Module Input State: External Blocking1
51X[1].ExBlo2-I	Module Input State: External Blocking2
51X[1].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
51X[1].Rvs Blo-I	Module Input State: Reverse Blocking
51X[1].AdaptSet1-I	Module Input State: Adaptive Parameter1
51X[1].AdaptSet2-I	Module Input State: Adaptive Parameter2

Name	*Description*
51X[1].AdaptSet3-I	Module Input State: Adaptive Parameter3
51X[1].AdaptSet4-I	Module Input State: Adaptive Parameter4
51X[2].Active	Signal: Active
51X[2].ExBlo	Signal: External Blocking
51X[2].Rvs Blo	Signal: Reverse Blocking
51X[2].Blo TripCmd	Signal: Trip Command blocked
51X[2].ExBlo TripCmd	Signal: External Blocking of the Trip Command
51X[2].Pickup	Signal: Pickup IX or IR
51X[2].Trip	Signal: Trip
51X[2].TripCmd	Signal: Trip Command
51X[2].IGH2 Blo	Signal: Blocked by IH2
51X[2].DefaultSet	Signal: Default Parameter Set
51X[2].AdaptSet 1	Signal: Adaptive Parameter 1
51X[2].AdaptSet 2	Signal: Adaptive Parameter 2
51X[2].AdaptSet 3	Signal: Adaptive Parameter 3
51X[2].AdaptSet 4	Signal: Adaptive Parameter 4
51X[2].ExBlo1-I	Module Input State: External Blocking1
51X[2].ExBlo2-I	Module Input State: External Blocking2
51X[2].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
51X[2].Rvs Blo-I	Module Input State: Reverse Blocking
51X[2].AdaptSet1-I	Module Input State: Adaptive Parameter1
51X[2].AdaptSet2-I	Module Input State: Adaptive Parameter2
51X[2].AdaptSet3-I	Module Input State: Adaptive Parameter3
51X[2].AdaptSet4-I	Module Input State: Adaptive Parameter4
50R[1].Active	Signal: Active
50R[1].ExBlo	Signal: External Blocking
50R[1].Rvs Blo	Signal: Reverse Blocking
50R[1].Blo TripCmd	Signal: Trip Command blocked
50R[1].ExBlo TripCmd	Signal: External Blocking of the Trip Command
50R[1].Pickup	Signal: Pickup IX or IR
50R[1].Trip	Signal: Trip
50R[1].TripCmd	Signal: Trip Command
50R[1].IGH2 Blo	Signal: Blocked by IH2
50R[1].DefaultSet	Signal: Default Parameter Set
50R[1].AdaptSet 1	Signal: Adaptive Parameter 1
50R[1].AdaptSet 2	Signal: Adaptive Parameter 2
50R[1].AdaptSet 3	Signal: Adaptive Parameter 3
50R[1].AdaptSet 4	Signal: Adaptive Parameter 4
50R[1].ExBlo1-I	Module Input State: External Blocking1
50R[1].ExBlo2-I	Module Input State: External Blocking2
50R[1].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command

Name	*Description*
50R[1].Rvs Blo-I	Module Input State: Reverse Blocking
50R[1].AdaptSet1-I	Module Input State: Adaptive Parameter1
50R[1].AdaptSet2-I	Module Input State: Adaptive Parameter2
50R[1].AdaptSet3-I	Module Input State: Adaptive Parameter3
50R[1].AdaptSet4-I	Module Input State: Adaptive Parameter4
50R[2].Active	Signal: Active
50R[2].ExBlo	Signal: External Blocking
50R[2].Rvs Blo	Signal: Reverse Blocking
50R[2].Blo TripCmd	Signal: Trip Command blocked
50R[2].ExBlo TripCmd	Signal: External Blocking of the Trip Command
50R[2].Pickup	Signal: Pickup IX or IR
50R[2].Trip	Signal: Trip
50R[2].TripCmd	Signal: Trip Command
50R[2].IGH2 Blo	Signal: Blocked by IH2
50R[2].DefaultSet	Signal: Default Parameter Set
50R[2].AdaptSet 1	Signal: Adaptive Parameter 1
50R[2].AdaptSet 2	Signal: Adaptive Parameter 2
50R[2].AdaptSet 3	Signal: Adaptive Parameter 3
50R[2].AdaptSet 4	Signal: Adaptive Parameter 4
50R[2].ExBlo1-I	Module Input State: External Blocking1
50R[2].ExBlo2-I	Module Input State: External Blocking2
50R[2].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
50R[2].Rvs Blo-I	Module Input State: Reverse Blocking
50R[2].AdaptSet1-I	Module Input State: Adaptive Parameter1
50R[2].AdaptSet2-I	Module Input State: Adaptive Parameter2
50R[2].AdaptSet3-I	Module Input State: Adaptive Parameter3
50R[2].AdaptSet4-I	Module Input State: Adaptive Parameter4
51R[1].Active	Signal: Active
51R[1].ExBlo	Signal: External Blocking
51R[1].Rvs Blo	Signal: Reverse Blocking
51R[1].Blo TripCmd	Signal: Trip Command blocked
51R[1].ExBlo TripCmd	Signal: External Blocking of the Trip Command
51R[1].Pickup	Signal: Pickup IX or IR
51R[1].Trip	Signal: Trip
51R[1].TripCmd	Signal: Trip Command
51R[1].IGH2 Blo	Signal: Blocked by IH2
51R[1].DefaultSet	Signal: Default Parameter Set
51R[1].AdaptSet 1	Signal: Adaptive Parameter 1
51R[1].AdaptSet 2	Signal: Adaptive Parameter 2
51R[1].AdaptSet 3	Signal: Adaptive Parameter 3
51R[1].AdaptSet 4	Signal: Adaptive Parameter 4

Name	*Description*
51R[1].ExBlo1-I	Module Input State: External Blocking1
51R[1].ExBlo2-I	Module Input State: External Blocking2
51R[1].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
51R[1].Rvs Blo-I	Module Input State: Reverse Blocking
51R[1].AdaptSet1-I	Module Input State: Adaptive Parameter1
51R[1].AdaptSet2-I	Module Input State: Adaptive Parameter2
51R[1].AdaptSet3-I	Module Input State: Adaptive Parameter3
51R[1].AdaptSet4-I	Module Input State: Adaptive Parameter4
51R[2].Active	Signal: Active
51R[2].ExBlo	Signal: External Blocking
51R[2].Rvs Blo	Signal: Reverse Blocking
51R[2].Blo TripCmd	Signal: Trip Command blocked
51R[2].ExBlo TripCmd	Signal: External Blocking of the Trip Command
51R[2].Pickup	Signal: Pickup IX or IR
51R[2].Trip	Signal: Trip
51R[2].TripCmd	Signal: Trip Command
51R[2].IGH2 Blo	Signal: Blocked by IH2
51R[2].DefaultSet	Signal: Default Parameter Set
51R[2].AdaptSet 1	Signal: Adaptive Parameter 1
51R[2].AdaptSet 2	Signal: Adaptive Parameter 2
51R[2].AdaptSet 3	Signal: Adaptive Parameter 3
51R[2].AdaptSet 4	Signal: Adaptive Parameter 4
51R[2].ExBlo1-I	Module Input State: External Blocking1
51R[2].ExBlo2-I	Module Input State: External Blocking2
51R[2].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
51R[2].Rvs Blo-I	Module Input State: Reverse Blocking
51R[2].AdaptSet1-I	Module Input State: Adaptive Parameter1
51R[2].AdaptSet2-I	Module Input State: Adaptive Parameter2
51R[2].AdaptSet3-I	Module Input State: Adaptive Parameter3
51R[2].AdaptSet4-I	Module Input State: Adaptive Parameter4
ZI[1].Active	Signal: Active
ZI[1].ExBlo	Signal: External Blocking
ZI[1].Blo TripCmd	Signal: Trip Command blocked
ZI[1].ExBlo TripCmd	Signal: External Blocking of the Trip Command
ZI[1].Bkr Blo	Signal: Blocked by Breaker Failure
ZI[1].Phase Pickup	Signal: Zone Interlocking Phase Pickup
ZI[1].Phase Trip	Signal: Zone Interlocking Phase Trip
ZI[1].Ground Pickup	Signal: Zone Interlocking Ground Pickup
ZI[1].Ground Trip	Signal: Zone Interlocking Ground Trip
ZI[1].Pickup	Signal: Pickup Zone Interlocking
ZI[1].Trip	Signal: Zone Interlocking Trip

Name	*Description*
ZI[1].TripCmd	Signal: Zone Interlocking Trip Command
ZI[1].Phase OUT	Signal: Zone Interlocking Phase OUT
ZI[1].Ground OUT	Signal: Zone Interlocking Ground OUT
ZI[1].OUT	Signal: Zone Interlocking OUT
ZI[1].IN	Signal: Zone Interlocking IN
ZI[1].ExBlo1-I	Module Input State: External Blocking1
ZI[1].ExBlo2-I	Module Input State: External Blocking2
ZI[1].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
ZI[1].Bkr Blo-I	Signal: Blocked by Breaker Failure
ZI[2].Active	Signal: Active
ZI[2].ExBlo	Signal: External Blocking
ZI[2].Blo TripCmd	Signal: Trip Command blocked
ZI[2].ExBlo TripCmd	Signal: External Blocking of the Trip Command
ZI[2].Bkr Blo	Signal: Blocked by Breaker Failure
ZI[2].Phase Pickup	Signal: Zone Interlocking Phase Pickup
ZI[2].Phase Trip	Signal: Zone Interlocking Phase Trip
ZI[2].Ground Pickup	Signal: Zone Interlocking Ground Pickup
ZI[2].Ground Trip	Signal: Zone Interlocking Ground Trip
ZI[2].Pickup	Signal: Pickup Zone Interlocking
ZI[2].Trip	Signal: Zone Interlocking Trip
ZI[2].TripCmd	Signal: Zone Interlocking Trip Command
ZI[2].Phase OUT	Signal: Zone Interlocking Phase OUT
ZI[2].Ground OUT	Signal: Zone Interlocking Ground OUT
ZI[2].OUT	Signal: Zone Interlocking OUT
ZI[2].IN	Signal: Zone Interlocking IN
ZI[2].ExBlo1-I	Module Input State: External Blocking1
ZI[2].ExBlo2-I	Module Input State: External Blocking2
ZI[2].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
ZI[2].Bkr Blo-I	Signal: Blocked by Breaker Failure
49.Active	Signal: Active
49.ExBlo	Signal: External Blocking
49.Blo TripCmd	Signal: Trip Command blocked
49.ExBlo TripCmd	Signal: External Blocking of the Trip Command
49.Alarm	Signal: Alarm Thermal Overload
49.Trip	Signal: Trip
49.TripCmd	Signal: Trip Command
49.Reset Thermal Cap	Signal: Resetting Thermal Replica
49.ExBlo1-I	Module Input State: External Blocking1
49.ExBlo2-I	Module Input State: External Blocking2
49.ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
51Q[1].Active	Signal: Active

Name	*Description*
51Q[1].ExBlo	Signal: External Blocking
51Q[1].Rvs Blo	Signal: Reverse Blocking
51Q[1].Blo TripCmd	Signal: Trip Command blocked
51Q[1].ExBlo TripCmd	Signal: External Blocking of the Trip Command
51Q[1].IH2 Blo	Signal: Blocking the trip command by IH2
51Q[1].Pickup	Signal: Pickup
51Q[1].Trip	Signal: Trip
51Q[1].TripCmd	Signal: Trip Command
51Q[1].DefaultSet	Signal: Default Parameter Set
51Q[1].AdaptSet 1	Signal: Adaptive Parameter 1
51Q[1].AdaptSet 2	Signal: Adaptive Parameter 2
51Q[1].AdaptSet 3	Signal: Adaptive Parameter 3
51Q[1].AdaptSet 4	Signal: Adaptive Parameter 4
51Q[1].ExBlo1-I	Module Input State: External Blocking1
51Q[1].ExBlo2-I	Module Input State: External Blocking2
51Q[1].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
51Q[1].Rvs Blo-I	Module Input State: Reverse Blocking
51Q[1].AdaptSet1-I	Module Input State: Adaptive Parameter1
51Q[1].AdaptSet2-I	Module Input State: Adaptive Parameter2
51Q[1].AdaptSet3-I	Module Input State: Adaptive Parameter3
51Q[1].AdaptSet4-I	Module Input State: Adaptive Parameter4
51Q[2].Active	Signal: Active
51Q[2].ExBlo	Signal: External Blocking
51Q[2].Rvs Blo	Signal: Reverse Blocking
51Q[2].Blo TripCmd	Signal: Trip Command blocked
51Q[2].ExBlo TripCmd	Signal: External Blocking of the Trip Command
51Q[2].IH2 Blo	Signal: Blocking the trip command by IH2
51Q[2].Pickup	Signal: Pickup
51Q[2].Trip	Signal: Trip
51Q[2].TripCmd	Signal: Trip Command
51Q[2].DefaultSet	Signal: Default Parameter Set
51Q[2].AdaptSet 1	Signal: Adaptive Parameter 1
51Q[2].AdaptSet 2	Signal: Adaptive Parameter 2
51Q[2].AdaptSet 3	Signal: Adaptive Parameter 3
51Q[2].AdaptSet 4	Signal: Adaptive Parameter 4
51Q[2].ExBlo1-I	Module Input State: External Blocking1
51Q[2].ExBlo2-I	Module Input State: External Blocking2
51Q[2].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
51Q[2].Rvs Blo-I	Module Input State: Reverse Blocking
51Q[2].AdaptSet1-I	Module Input State: Adaptive Parameter1
51Q[2].AdaptSet2-I	Module Input State: Adaptive Parameter2

Name	*Description*
51Q[2].AdaptSet3-I	Module Input State: Adaptive Parameter3
51Q[2].AdaptSet4-I	Module Input State: Adaptive Parameter4
IH2[1].Active	Signal: Active
IH2[1].ExBlo	Signal: External Blocking
IH2[1].Blo Phase A	Signal: Blocked Phase A
IH2[1].Blo Phase B	Signal: Blocked Phase B
IH2[1].Blo Phase C	Signal: Blocked Phase C
IH2[1].Blo IG	Signal: Blocking of the Earth Protection Module
IH2[1].3-ph Blo	Signal: Inrush was detected in at least one phase - trip command blocked.
IH2[1].ExBlo1-I	Module Input State: External Blocking1
IH2[1].ExBlo2-I	Module Input State: External Blocking2
IH2[2].Active	Signal: Active
IH2[2].ExBlo	Signal: External Blocking
IH2[2].Blo Phase A	Signal: Blocked Phase A
IH2[2].Blo Phase B	Signal: Blocked Phase B
IH2[2].Blo Phase C	Signal: Blocked Phase C
IH2[2].Blo IG	Signal: Blocking of the Earth Protection Module
IH2[2].3-ph Blo	Signal: Inrush was detected in at least one phase - trip command blocked.
IH2[2].ExBlo1-I	Module Input State: External Blocking1
IH2[2].ExBlo2-I	Module Input State: External Blocking2
SOTF.Active	Signal: Active
SOTF.ExBlo	Signal: External Blocking
SOTF.Rvs Blo	Signal: Reverse Blocking
SOTF.enabled	Signal: Switch Onto Fault enabled. This Signal can be used to modify Overcurrent Protection Settings.
SOTF.I<	Signal: No Load Current.
SOTF.ExBlo1-I	Module Input State: External Blocking
SOTF.ExBlo2-I	Module Input State: External Blocking
SOTF.Rvs Blo-I	Module Input State: Reverse Blocking
SOTF.Manual CLOSE-I	Module Input State: Breaker was switched on manually.
SOTF.Ext SOTF-I	Module Input State: External Switch Onto Fault Alarm
CLPU.Active	Signal: Active
CLPU.ExBlo	Signal: External Blocking
CLPU.Rvs Blo	Signal: Reverse Blocking
CLPU.enabled	Signal: Cold Load enabled
CLPU.detected	Signal: Cold Load detected
CLPU.I<	Signal: No Load Current.
CLPU.ExBlo1-I	Module Input State: External Blocking
CLPU.ExBlo2-I	Module Input State: External Blocking
CLPU.Rvs Blo-I	Module Input State: Reverse Blocking

Name	*Description*
ExP[1].Active	Signal: Active
ExP[1].ExBlo	Signal: External Blocking
ExP[1].Blo TripCmd	Signal: Trip Command blocked
ExP[1].ExBlo TripCmd	Signal: External Blocking of the Trip Command
ExP[1].Alarm	Signal: Alarm
ExP[1].Trip	Signal: Trip
ExP[1].TripCmd	Signal: Trip Command
ExP[1].ExBlo1-I	Module Input State: External Blocking1
ExP[1].ExBlo2-I	Module Input State: External Blocking2
ExP[1].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
ExP[1].Alarm-I	Module Input State: Alarm
ExP[1].Trip-I	Module Input State: Trip
ExP[2].Active	Signal: Active
ExP[2].ExBlo	Signal: External Blocking
ExP[2].Blo TripCmd	Signal: Trip Command blocked
ExP[2].ExBlo TripCmd	Signal: External Blocking of the Trip Command
ExP[2].Alarm	Signal: Alarm
ExP[2].Trip	Signal: Trip
ExP[2].TripCmd	Signal: Trip Command
ExP[2].ExBlo1-I	Module Input State: External Blocking1
ExP[2].ExBlo2-I	Module Input State: External Blocking2
ExP[2].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
ExP[2].Alarm-I	Module Input State: Alarm
ExP[2].Trip-I	Module Input State: Trip
ExP[3].Active	Signal: Active
ExP[3].ExBlo	Signal: External Blocking
ExP[3].Blo TripCmd	Signal: Trip Command blocked
ExP[3].ExBlo TripCmd	Signal: External Blocking of the Trip Command
ExP[3].Alarm	Signal: Alarm
ExP[3].Trip	Signal: Trip
ExP[3].TripCmd	Signal: Trip Command
ExP[3].ExBlo1-I	Module Input State: External Blocking1
ExP[3].ExBlo2-I	Module Input State: External Blocking2
ExP[3].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
ExP[3].Alarm-I	Module Input State: Alarm
ExP[3].Trip-I	Module Input State: Trip
ExP[4].Active	Signal: Active
ExP[4].ExBlo	Signal: External Blocking
ExP[4].Blo TripCmd	Signal: Trip Command blocked
ExP[4].ExBlo TripCmd	Signal: External Blocking of the Trip Command
ExP[4].Alarm	Signal: Alarm

Name	*Description*
ExP[4].Trip	Signal: Trip
ExP[4].TripCmd	Signal: Trip Command
ExP[4].ExBlo1-I	Module Input State: External Blocking1
ExP[4].ExBlo2-I	Module Input State: External Blocking2
ExP[4].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
ExP[4].Alarm-I	Module Input State: Alarm
ExP[4].Trip-I	Module Input State: Trip
Sudden Press.Active	Signal: Active
Sudden Press.ExBlo	Signal: External Blocking
Sudden Press.Blo TripCmd	Signal: Trip Command blocked
Sudden Press.ExBlo TripCmd	Signal: External Blocking of the Trip Command
Sudden Press.Alarm	Signal: Alarm
Sudden Press.Trip	Signal: Trip
Sudden Press.TripCmd	Signal: Trip Command
Sudden Press.ExBlo1-I	Module Input State: External Blocking1
Sudden Press.ExBlo2-I	Module Input State: External Blocking2
Sudden Press.ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
Sudden Press.Alarm-I	Module Input State: Alarm
Sudden Press.Trip-I	Module Input State: Trip
Ext Oil Temp.Active	Signal: Active
Ext Oil Temp.ExBlo	Signal: External Blocking
Ext Oil Temp.Blo TripCmd	Signal: Trip Command blocked
Ext Oil Temp.ExBlo TripCmd	Signal: External Blocking of the Trip Command
Ext Oil Temp.Alarm	Signal: Alarm
Ext Oil Temp.Trip	Signal: Trip
Ext Oil Temp.TripCmd	Signal: Trip Command
Ext Oil Temp.ExBlo1-I	Module Input State: External Blocking1
Ext Oil Temp.ExBlo2-I	Module Input State: External Blocking2
Ext Oil Temp.ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
Ext Oil Temp.Alarm-I	Module Input State: Alarm
Ext Oil Temp.Trip-I	Module Input State: Trip
Ext Temp Superv[1].Active	Signal: Active
Ext Temp Superv[1].ExBlo	Signal: External Blocking
Ext Temp Superv[1].Blo TripCmd	Signal: Trip Command blocked
Ext Temp Superv[1].ExBlo TripCmd	Signal: External Blocking of the Trip Command
Ext Temp Superv[1].Alarm	Signal: Alarm
Ext Temp Superv[1].Trip	Signal: Trip
Ext Temp Superv[1].TripCmd	Signal: Trip Command
Ext Temp Superv[1].ExBlo1-I	Module Input State: External Blocking1
Ext Temp Superv[1].ExBlo2-I	Module Input State: External Blocking2
Ext Temp Superv[1].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command

Name	*Description*
Ext Temp Superv[1].Alarm-I	Module Input State: Alarm
Ext Temp Superv[1].Trip-I	Module Input State: Trip
Ext Temp Superv[2].Active	Signal: Active
Ext Temp Superv[2].ExBlo	Signal: External Blocking
Ext Temp Superv[2].Blo TripCmd	Signal: Trip Command blocked
Ext Temp Superv[2].ExBlo TripCmd	Signal: External Blocking of the Trip Command
Ext Temp Superv[2].Alarm	Signal: Alarm
Ext Temp Superv[2].Trip	Signal: Trip
Ext Temp Superv[2].TripCmd	Signal: Trip Command
Ext Temp Superv[2].ExBlo1-I	Module Input State: External Blocking1
Ext Temp Superv[2].ExBlo2-I	Module Input State: External Blocking2
Ext Temp Superv[2].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
Ext Temp Superv[2].Alarm-I	Module Input State: Alarm
Ext Temp Superv[2].Trip-I	Module Input State: Trip
Ext Temp Superv[3].Active	Signal: Active
Ext Temp Superv[3].ExBlo	Signal: External Blocking
Ext Temp Superv[3].Blo TripCmd	Signal: Trip Command blocked
Ext Temp Superv[3].ExBlo TripCmd	Signal: External Blocking of the Trip Command
Ext Temp Superv[3].Alarm	Signal: Alarm
Ext Temp Superv[3].Trip	Signal: Trip
Ext Temp Superv[3].TripCmd	Signal: Trip Command
Ext Temp Superv[3].ExBlo1-I	Module Input State: External Blocking1
Ext Temp Superv[3].ExBlo2-I	Module Input State: External Blocking2
Ext Temp Superv[3].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
Ext Temp Superv[3].Alarm-I	Module Input State: Alarm
Ext Temp Superv[3].Trip-I	Module Input State: Trip
URTD.W1-A Superv	Signal: Supervision Channel W1-A
URTD.W1-B Superv	Signal: Supervision Channel W1-B
URTD.W1-C Superv	Signal: Supervision Channel W1-C
URTD.W2-A Superv	Signal: Supervision Channel W2-A
URTD.W2-B Superv	Signal: Supervision Channel W2-B
URTD.W2-C Superv	Signal: Supervision Channel W2-C
URTD.Amb1 Superv	Signal: Supervision Channel Amb1
URTD.Amb2 Superv	Signal: Supervision Channel Amb2
URTD.Aux1 Superv	Signal: Supervision Channel Aux1
URTD.Aux2 Superv	Signal: Supervision Channel Aux2
URTD.Aux3 Superv	Signal: Supervision Channel Aux3
URTD.Superv	Signal: URTD Supervision Channel
URTD.active	Signal: URTD active
RTD.Active	Signal: Active
RTD.ExBlo	Signal: External Blocking

Name	*Description*
RTD.Blo TripCmd	Signal: Trip Command blocked
RTD.ExBlo TripCmd	Signal: External Blocking of the Trip Command
RTD.Alarm	Alarm RTD Temperature Protection
RTD.Trip	Signal: Trip
RTD.TripCmd	Signal: Trip Command
RTD.W1-A Trip	Winding1 Phase A Signal: Trip
RTD.W1-A Alarm	Winding1 Phase A Alarm RTD Temperature Protection
RTD.W1-A Timeout Alarm	Winding1 Phase A Timeout Alarm
RTD.W1-A Invalid	Winding1 Phase A Signal: Invalid Temperature Measurement Value (e.g caused by an defective or interuppted RTD Measurement)
RTD.W1-B Trip	Winding1 Phase B Signal: Trip
RTD.W1-B Alarm	Winding1 Phase B Alarm RTD Temperature Protection
RTD.W1-B Timeout Alarm	Winding1 Phase B Timeout Alarm
RTD.W1-B Invalid	Winding1 Phase B Signal: Invalid Temperature Measurement Value (e.g caused by an defective or interuppted RTD Measurement)
RTD.W1-C Trip	Winding1 Phase C Signal: Trip
RTD.W1-C Alarm	Winding1 Phase C Alarm RTD Temperature Protection
RTD.W1-C Timeout Alarm	Winding1 Phase C Timeout Alarm
RTD.W1-C Invalid	Winding1 Phase C Signal: Invalid Temperature Measurement Value (e.g caused by an defective or interuppted RTD Measurement)
RTD.W2-A Trip	Winding2 Phase A Signal: Trip
RTD.W2-A Alarm	Winding2 Phase A Alarm RTD Temperature Protection
RTD.W2-A Timeout Alarm	Winding2 Phase A Timeout Alarm
RTD.W2-A Invalid	Winding2 Phase A Signal: Invalid Temperature Measurement Value (e.g caused by an defective or interuppted RTD Measurement)
RTD.W2-B Trip	Winding2 Phase B Signal: Trip
RTD.W2-B Alarm	Winding2 Phase B Alarm RTD Temperature Protection
RTD.W2-B Timeout Alarm	Winding2 Phase B Timeout Alarm
RTD.W2-B Invalid	Winding2 Phase B Signal: Invalid Temperature Measurement Value (e.g caused by an defective or interuppted RTD Measurement)
RTD.W2-C Trip	Winding2 Phase C Signal: Trip
RTD.W2-C Alarm	Winding2 Phase C Alarm RTD Temperature Protection
RTD.W2-C Timeout Alarm	Winding2 Phase C Timeout Alarm
RTD.W2-C Invalid	Winding2 Phase C Signal: Invalid Temperature Measurement Value (e.g caused by an defective or interuppted RTD Measurement)
RTD.Amb 1 Trip	Ambient 1 Signal: Trip
RTD.Amb 1 Alarm	Ambient 1 Alarm RTD Temperature Protection
RTD.Amb 1 Timeout Alarm	Ambient 1 Timeout Alarm
RTD.Amb 1 Invalid	Ambient 1 Signal: Invalid Temperature Measurement Value (e.g caused by an defective or interuppted RTD Measurement)
RTD.Amb 2 Trip	Ambient 2 Signal: Trip
RTD.Amb 2 Alarm	Ambient 2 Alarm RTD Temperature Protection
RTD.Amb 2 Timeout Alarm	Ambient 2 Timeout Alarm

Name	*Description*
RTD.Amb 2 Invalid	Ambient 2 Signal: Invalid Temperature Measurement Value (e.g caused by an defective or interuppted RTD Measurement)
RTD.Aux 1 Trip	Auxiliary 1 Signal: Trip
RTD.Aux 1 Alarm	Auxiliary 1 Alarm RTD Temperature Protection
RTD.Aux 1 Timeout Alarm	Auxiliary 1 Timeout Alarm
RTD.Aux 1 Invalid	Auxiliary 1 Signal: Invalid Temperature Measurement Value (e.g caused by an defective or interuppted RTD Measurement)
RTD.Aux 2 Trip	Auxiliary 2 Signal: Trip
RTD.Aux 2 Alarm	Auxiliary 2 Alarm RTD Temperature Protection
RTD.Aux 2 Timeout Alarm	Auxiliary 2 Timeout Alarm
RTD.Aux 2 Invalid	Auxiliary 2 Signal: Invalid Temperature Measurement Value (e.g caused by an defective or interuppted RTD Measurement)
RTD.Aux 3 Trip	Auxiliary 3 Signal: Trip
RTD.Aux 3 Alarm	Auxiliary 3 Alarm RTD Temperature Protection
RTD.Aux 3 Timeout Alarm	Auxiliary 3 Timeout Alarm
RTD.Aux 3 Invalid	Auxiliary 4 Signal: Invalid Temperature Measurement Value (e.g caused by an defective or interuppted RTD Measurement)
RTD.Trip all Any Group	Trip all Any Group
RTD.Alarm all Any Group	Alarm all Any Group
RTD.Timeout Alarm all Any Group	Timeout Alarm all Any Group
RTD.ExBlo1-I	Module Input State: External Blocking1
RTD.ExBlo2-I	Module Input State: External Blocking2
RTD.ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
BF[1].Active	Signal: Active
BF[1].ExBlo	Signal: External Blocking
BF[1].Pickup	Signal: BF-Module Started (Pickup)
BF[1].Trip	Signal: Breaker Failure Trip
BF[1].ExBlo1-I	Module Input State: External Blocking1
BF[1].ExBlo2-I	Module Input State: External Blocking2
BF[1].Trigger1	Module Input: Trigger that will start the BF
BF[1].Trigger2	Module Input: Trigger that will start the BF
BF[1].Trigger3	Module Input: Trigger that will start the BF
BF[2].Active	Signal: Active
BF[2].ExBlo	Signal: External Blocking
BF[2].Pickup	Signal: BF-Module Started (Pickup)
BF[2].Trip	Signal: Breaker Failure Trip
BF[2].ExBlo1-I	Module Input State: External Blocking1
BF[2].ExBlo2-I	Module Input State: External Blocking2
BF[2].Trigger1	Module Input: Trigger that will start the BF
BF[2].Trigger2	Module Input: Trigger that will start the BF
BF[2].Trigger3	Module Input: Trigger that will start the BF
TCM[1].Active	Signal: Active

Name	*Description*
TCM[1].ExBlo	Signal: External Blocking
TCM[1].Pickup	Signal: Pickup Trip Circuit Supervision
TCM[1].Not Possible	Not possible because no state indicator assigned to the breaker.
TCM[1].CinBkr-52a	Position indicator/check-back signal of the Bkr (52a)
TCM[1].CinBkr-52b	Module Input State: Position indicator/check-back signal of the Bkr. (52b)
TCM[1].ExBlo1-I	Module Input State: External Blocking1
TCM[1].ExBlo2-I	Module Input State: External Blocking2
TCM[2].Active	Signal: Active
TCM[2].ExBlo	Signal: External Blocking
TCM[2].Pickup	Signal: Pickup Trip Circuit Supervision
TCM[2].Not Possible	Not possible because no state indicator assigned to the breaker.
TCM[2].CinBkr-52a	Position indicator/check-back signal of the Bkr (52a)
TCM[2].CinBkr-52b	Module Input State: Position indicator/check-back signal of the Bkr. (52b)
TCM[2].ExBlo1-I	Module Input State: External Blocking1
TCM[2].ExBlo2-I	Module Input State: External Blocking2
CTS[1].Active	Signal: Active
CTS[1].ExBlo	Signal: External Blocking
CTS[1].Pickup	Signal: Pickup Current Transformer Measuring Circuit Supervision
CTS[1].ExBlo1-I	Module Input State: External Blocking1
CTS[1].ExBlo2-I	Module Input State: External Blocking2
CTS[2].Active	Signal: Active
CTS[2].ExBlo	Signal: External Blocking
CTS[2].Pickup	Signal: Pickup Current Transformer Measuring Circuit Supervision
CTS[2].ExBlo1-I	Module Input State: External Blocking1
CTS[2].ExBlo2-I	Module Input State: External Blocking2
DI Slot X1.DI 1	Signal: Digital Input
DI Slot X1.DI 2	Signal: Digital Input
DI Slot X1.DI 3	Signal: Digital Input
DI Slot X1.DI 4	Signal: Digital Input
DI Slot X1.DI 5	Signal: Digital Input
DI Slot X1.DI 6	Signal: Digital Input
DI Slot X1.DI 7	Signal: Digital Input
DI Slot X1.DI 8	Signal: Digital Input
RO Slot X2.ZI OUT	Signal: Zone Interlocking OUT
RO Slot X2.RO 1	Signal: Relay Output
RO Slot X2.RO 2	Signal: Relay Output
RO Slot X2.RO 3	Signal: Relay Output
RO Slot X2.RO 4	Signal: Relay Output

Name	*Description*
RO Slot X2.DISARMED!	Signal: CAUTION! RELAYS DISARMED in order to safely perform maintenance while eliminating the risk of taking an entire process off-line. (Note: Zone Interlocking and Supervision Contact cannot be disarmed). YOU MUST ENSURE that the relays are ARMED AGAIN after maintenance
RO Slot X2.Outs forced	Signal: The State of at least one Relay Output has been set by force. That means that the state of at least one Relay is forced and hence does not show the state of the assined signals.
RO Slot X5.ZI OUT	Signal: Zone Interlocking OUT
RO Slot X5.RO 1	Signal: Relay Output
RO Slot X5.RO 2	Signal: Relay Output
RO Slot X5.RO 3	Signal: Relay Output
RO Slot X5.RO 4	Signal: Relay Output
RO Slot X5.DISARMED!	Signal: CAUTION! RELAYS DISARMED in order to safely perform maintenance while eliminating the risk of taking an entire process off-line. (Note: Zone Interlocking and Supervision Contact cannot be disarmed). YOU MUST ENSURE that the relays are ARMED AGAIN after maintenance
RO Slot X5.Outs forced	Signal: The State of at least one Relay Output has been set by force. That means that the state of at least one Relay is forced and hence does not show the state of the assined signals.
Event rec.Reset all rec	Signal: All records deleted
Disturb rec.Recording	Signal: Recording
Disturb rec.Write err	Signal: Writing Error in Memory
Disturb rec.Memory full	Signal: Memory Full
Disturb rec.Clear fail	Signal: Clear Failure in Memory
Disturb rec.Reset all rec	Signal: All records deleted
Disturb rec.Reset record	Signal: Delete Record
Disturb rec.Man. Trigger	Signal: Manual Trigger
Disturb rec.Start1-I	State of the module input: Trigger event / start recording if:
Disturb rec.Start2-I	State of the module input: Trigger event / start recording if:
Disturb rec.Start3-I	State of the module input: Trigger event / start recording if:
Disturb rec.Start4-I	State of the module input: Trigger event / start recording if:
Disturb rec.Start5-I	State of the module input: Trigger event / start recording if:
Disturb rec.Start6-I	State of the module input: Trigger event / start recording if:
Disturb rec.Start7-I	State of the module input: Trigger event / start recording if:
Disturb rec.Start8-I	State of the module input: Trigger event / start recording if:
Fault rec.Reset record	Signal: Delete Record
Fault rec.Man. Trigger	Signal: Manual Trigger
Fault rec.Start1-I	State of the module input: Trigger event / start recording if:
Fault rec.Start2-I	State of the module input: Trigger event / start recording if:
Fault rec.Start3-I	State of the module input: Trigger event / start recording if:
Fault rec.Start4-I	State of the module input: Trigger event / start recording if:
Fault rec.Start5-I	State of the module input: Trigger event / start recording if:
Fault rec.Start6-I	State of the module input: Trigger event / start recording if:

Name	*Description*
Fault rec.Start7-I	State of the module input: Trigger event / start recording if:
Fault rec.Start8-I	State of the module input: Trigger event / start recording if:
Modbus.Transmission	Signal: Communication Active
Modbus.Comm Cmd 1	Communication Command
Modbus.Comm Cmd 2	Communication Command
Modbus.Comm Cmd 3	Communication Command
Modbus.Comm Cmd 4	Communication Command
Modbus.Comm Cmd 5	Communication Command
Modbus.Comm Cmd 6	Communication Command
Modbus.Comm Cmd 7	Communication Command
Modbus.Comm Cmd 8	Communication Command
Modbus.Comm Cmd 9	Communication Command
Modbus.Comm Cmd 10	Communication Command
Modbus.Comm Cmd 11	Communication Command
Modbus.Comm Cmd 12	Communication Command
Modbus.Comm Cmd 13	Communication Command
Modbus.Comm Cmd 14	Communication Command
Modbus.Comm Cmd 15	Communication Command
Modbus.Comm Cmd 16	Communication Command
IRIG-B.Active	Signal: Active
IRIG-B.Inverted	Signal: IRIG-B inverted
IRIG-B.Control Signal1	Signal: IRIG-B Control Signal
IRIG-B.Control Signal2	Signal: IRIG-B Control Signal
IRIG-B.Control Signal4	Signal: IRIG-B Control Signal
IRIG-B.Control Signal5	Signal: IRIG-B Control Signal
IRIG-B.Control Signal6	Signal: IRIG-B Control Signal
IRIG-B.Control Signal7	Signal: IRIG-B Control Signal
IRIG-B.Control Signal8	Signal: IRIG-B Control Signal
IRIG-B.Control Signal9	Signal: IRIG-B Control Signal
IRIG-B.Control Signal10	Signal: IRIG-B Control Signal
IRIG-B.Control Signal11	Signal: IRIG-B Control Signal
IRIG-B.Control Signal12	Signal: IRIG-B Control Signal
IRIG-B.Control Signal13	Signal: IRIG-B Control Signal
IRIG-B.Control Signal14	Signal: IRIG-B Control Signal
IRIG-B.Control Signal15	Signal: IRIG-B Control Signal
IRIG-B.Control Signal16	Signal: IRIG-B Control Signal
IRIG-B.Control Signal17	Signal: IRIG-B Control Signal
IRIG-B.Control Signal18	Signal: IRIG-B Control Signal
Statistics.Reset	Signal: Reset of Statistics
Statistics.StartFct-I	Module input state: Start statistics Module input signal
Statistics.ResetFct-I	Module Input State: Reset Statistics Module input signal

Name	*Description*
Sys.PS 1	Signal: Parameter Set 1
Sys.PS 2	Signal: Parameter Set 2
Sys.PS 3	Signal: Parameter Set 3
Sys.PS 4	Signal: Parameter Set 4
Sys.PSS manual	Signal: Manual switch over of a Parameter Set
Sys.PSS via Comm	Signal: Parameter Set Switch via Communication
Sys.PSS via Inp fct	Signal: Parameter Set Switch via Input Function
Sys.Min. 1 param changed	Signal: At least one parameter has been changed
Sys.Maint Mode Active	Signal: Arc Flash Reduction Maintenance Active
Sys.Maint Mode Inactive	Signal: Arc Flash Reduction Maintenance Inactive
Sys.Maint Mode Manually	Signal: Arc Flash Reduction Maintenance Manual Mode
Sys.Maint Mode Comm	Signal: Arc Flash Reduction Maintenance Comm Mode
Sys.Maint Mode DI	Signal: Arc Flash Reduction Maintenance Digital Input Mode
Sys.Ack LED	Signal: LEDs Acknowledgment
Sys.Ack RO	Signal: Acknowledgment of the Relay Outputs
Sys.Ack Comm	Signal: Acknowledge Communication
Sys.Ack TripCmd	Signal: Reset Trip Command
Sys.Ack LED-HMI	Signal: LEDs Acknowledgment :HMI
Sys.Ack RO-HMI	Signal: Acknowledgment of the Relay Outputs :HMI
Sys.Ack Comm-HMI	Signal: Acknowledge Communication :HMI
Sys.Ack TripCmd-HMI	Signal: Reset Trip Command :HMI
Sys.Ack LED-Comm	Signal: LEDs Acknowledgment :Communication
Sys.Ack RO-Comm	Signal: Acknowledgment of the Relay Outputs :Communication
Sys.Ack Counter-Comm	Signal: Reset of all Counters :Communication
Sys.Ack Comm-Comm	Signal: Acknowledge Communication :Communication
Sys.Ack TripCmd-Comm	Signal: Reset Trip Command :Communication
Sys.Ack LED-I	Module Input State: LEDs Acknowledgment by Digital Input.
Sys.Ack RO-I	Module Input State: Acknowledgment of the Relay Outputs.
Sys.Ack Comm-I	Module Input State: Acknowledge Communication via Digital Input. The replica that Communication has received from the device is to be reset.
Sys.PS1-I	State of the module input, respectively of the signal, that should activate this Parameter Setting Group.
Sys.PS2-I	State of the module input, respectively of the signal, that should activate this Parameter Setting Group.
Sys.PS3-I	State of the module input, respectively of the signal, that should activate this Parameter Setting Group.
Sys.PS4-I	State of the module input, respectively of the signal, that should activate this Parameter Setting Group.
Sys.Maint Mode-I	Module Input State: Arc Flash Reduction Maintenance Switch

Status Display

In the status display within the »Operation« menu, the present state of all signals of the »ASSIGNMENT LIST« can be viewed. This means the User is able to see if the individual signals are active or inactive at that moment. The User can choose whether to see all signals in an overall status or view the signals sorted by modules.

State of the Module Input / Signal Is...	*Is Shown at the Panel as...*
false / »0«	
true / »1«	

Status Display via PowerPort E

- If PowerPort E is not running, please start the application.
- If the device data have not been downloaded recently, select »Receive Data From The Device« from »Device« menu.
- Double click on the »Operation« icon in the navigation tree.
- Double click on the »Status Display« icon within the operational data.
- Double click the »Overall status« i to see all signals at once or call up a specific module to see the states.
- The User can see the state of all corresponding signals on the window.

NOTICE **To have the status display updated in a cyclic manner, select »Automatic Up-Date« in the »*VIEW*« menu.**

State of the Module Input / Signal Is...	*Is Shown in PowerPort-E as...*
false / »0«	0
true / »1«	1
No connection to the device	?

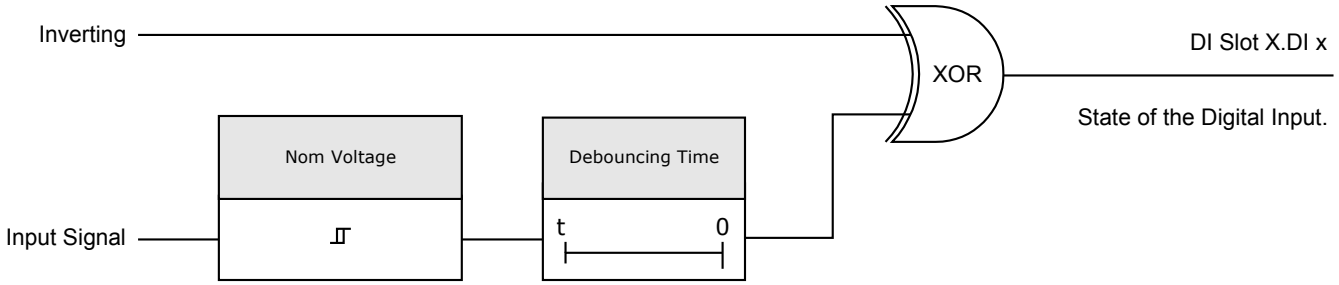
Module: Digital Inputs (DIs)

CAUTION

Based on the »Assignment list« settings, the states of the digital inputs are mapped to the application module.

Set the following parameters for each of the digital inputs:

- *»Nominal voltage«*
- *»Debouncing time«*: A state change will only be adopted by the digital input after the debouncing time has expired.
- *»Inverting«* (where necessary)



CAUTION

The debouncing time will be started each time the state of the input signal alternates.

Digital Inputs (Standard)

DI Slot X1

Global Protection Parameters of the Digital Inputs (Standards)

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Nom Voltage	Nominal voltage of the digital inputs	24 V dc, 48 V dc, 60 V dc, 110/120 V dc, 230/240 V dc, 110/120 V ac, 230/240 V ac	110/120 V dc	[Device Para /Digital Inputs /DI Slot X1 /Group 1]
Inverting 1	Inverting the input signals.	Inactive, Active	Inactive	[Device Para /Digital Inputs /DI Slot X1 /Group 1]
Debouncing Time 1	A change of the state of a digital input will only be recognized after the debouncing time has expired (become effective). Thus, wipers will not be misinterpreted.	No Debouncing Time, 20 ms, 50 ms, 100 ms	20 ms	[Device Para /Digital Inputs /DI Slot X1 /Group 1]
Nom Voltage	Nominal voltage of the digital inputs	24 V dc, 48 V dc, 60 V dc, 110/120 V dc, 230/240 V dc, 110/120 V ac, 230/240 V ac	110/120 V dc	[Device Para /Digital Inputs /DI Slot X1 /Group 2]
Inverting 2	Inverting the input signals.	Inactive, Active	Inactive	[Device Para /Digital Inputs /DI Slot X1 /Group 2]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Debouncing Time 2	A change of the state of a digital input will only be recognized after the debouncing time has expired (become effective). Thus, wipers will not be misinterpreted.	No Debouncing Time, 20 ms, 50 ms, 100 ms	20 ms	[Device Para /Digital Inputs /DI Slot X1 /Group 2]
Nom Voltage	Nominal voltage of the digital inputs	24 V dc, 48 V dc, 60 V dc, 110/120 V dc, 230/240 V dc, 110/120 V ac, 230/240 V ac	110/120 V dc	[Device Para /Digital Inputs /DI Slot X1 /Group 3]
Inverting 3	Inverting the input signals.	Inactive, Active	Inactive	[Device Para /Digital Inputs /DI Slot X1 /Group 3]
Debouncing Time 3	A change of the state of a digital input will only be recognized after the debouncing time has expired (become effective). Thus, wipers will not be misinterpreted.	No Debouncing Time, 20 ms, 50 ms, 100 ms	20 ms	[Device Para /Digital Inputs /DI Slot X1 /Group 3]
Inverting 4	Inverting the input signals.	Inactive, Active	Inactive	[Device Para /Digital Inputs /DI Slot X1 /Group 3]
Debouncing Time 4	A change of the state of a digital input will only be recognized after the debouncing time has expired (become effective). Thus, wipers will not be misinterpreted.	No Debouncing Time, 20 ms, 50 ms, 100 ms	20 ms	[Device Para /Digital Inputs /DI Slot X1 /Group 3]
Inverting 5	Inverting the input signals.	Inactive, Active	Inactive	[Device Para /Digital Inputs /DI Slot X1 /Group 3]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Debouncing Time 5	A change of the state of a digital input will only be recognized after the debouncing time has expired (become effective). Thus, wipers will not be misinterpreted.	No Debouncing Time, 20 ms, 50 ms, 100 ms	20 ms	[Device Para /Digital Inputs /DI Slot X1 /Group 3]
Inverting 6	Inverting the input signals.	Inactive, Active	Inactive	[Device Para /Digital Inputs /DI Slot X1 /Group 3]
Debouncing Time 6	A change of the state of a digital input will only be recognized after the debouncing time has expired (become effective). Thus, wipers will not be misinterpreted.	No Debouncing Time, 20 ms, 50 ms, 100 ms	20 ms	[Device Para /Digital Inputs /DI Slot X1 /Group 3]
Inverting 7	Inverting the input signals.	Inactive, Active	Inactive	[Device Para /Digital Inputs /DI Slot X1 /Group 3]
Debouncing Time 7	A change of the state of a digital input will only be recognized after the debouncing time has expired (become effective). Thus, wipers will not be misinterpreted.	No Debouncing Time, 20 ms, 50 ms, 100 ms	20 ms	[Device Para /Digital Inputs /DI Slot X1 /Group 3]
Inverting 8	Inverting the input signals.	Inactive, Active	Inactive	[Device Para /Digital Inputs /DI Slot X1 /Group 3]
Debouncing Time 8	A change of the state of a digital input will only be recognized after the debouncing time has expired (become effective). Thus, wipers will not be misinterpreted. 8	No Debouncing Time, 20 ms, 50 ms, 100 ms	20 ms	[Device Para /Digital Inputs /DI Slot X1 /Group 3]

Digital Inputs Signals (Outputs States)

Name	*Description*
DI 1	Signal: Digital Input
DI 2	Signal: Digital Input
DI 3	Signal: Digital Input
DI 4	Signal: Digital Input
DI 5	Signal: Digital Input
DI 6	Signal: Digital Input
DI 7	Signal: Digital Input
DI 8	Signal: Digital Input

Relay Output Contacts

RO Slot X2 ,RO Slot X5

The states of the module outputs and the signals (e.g. states of protective functions) can be assigned to the relay output contacts. The relay output contacts are “dry-type“ contacts.

A latched relay output contact will return to it's latched position after a loss of power to the protective device. A latched relay output contact will keep it´s position as long as it has not been reset and as long as the power supply feeds the protective relay. In the case of a loss of power to the protective device, the relays will return to the latched position once the power is restored to the protective device (latched = relay output contacts have a memory).

A latched state of a relay output contact always needs to be reset after a power loss even if the assignments are taken away (if the assignments are reprogrammed).

Set the following parameters for each of the relay output contacts.

- Up to seven (7) signals from the »assignment list« (OR-connected).
- Each of the assigned signals can be inverted.
- The (collective) state of the relay output contacts can be inverted.
- Each relay output contact can be set as *»Latched«* (Latched = active or inactive).
- *Latched = inactive«*:
  If the latching function is *»inactive«*, the relay output and, respectively, the relay output contact will adopt the state of those pickups that were assigned.
- *»Latched = active«:*
  If the latching function is *»active«*, the state of the relay output and, respectively, the relay output contact that was set by the pickups will be stored (they have a memory that needs to be reset).

  The relay output contact can only be acknowledged after reset of those signals that had initiated the setting of the relay and after expiration of the »*t-OFF delay«*.
- At signal changes, the minimal latching time (*»t-OFF delay«*) ensures that the relay will be maintained as picked-up or released for at least this period.

CAUTION

If the relay output contacts are configured as »Latched=*active«,* they will keep (return to) their position even if there is a power outage within the power supply of the protective device.

If the relay output contacts are configured as »Latched=active«, they will also retain their position even if they are reprogrammed in another way. This also applies if the relay output contacts are set to »Latched is set to ina*ctive«*. Resetting a relay output contact that has latched a signal will always require an acknowledgement.

NOTICE

The *»System OK Relay«* (watchdog) cannot be configured.

Acknowledgment Options

Relay output contacts can be acknowledged:

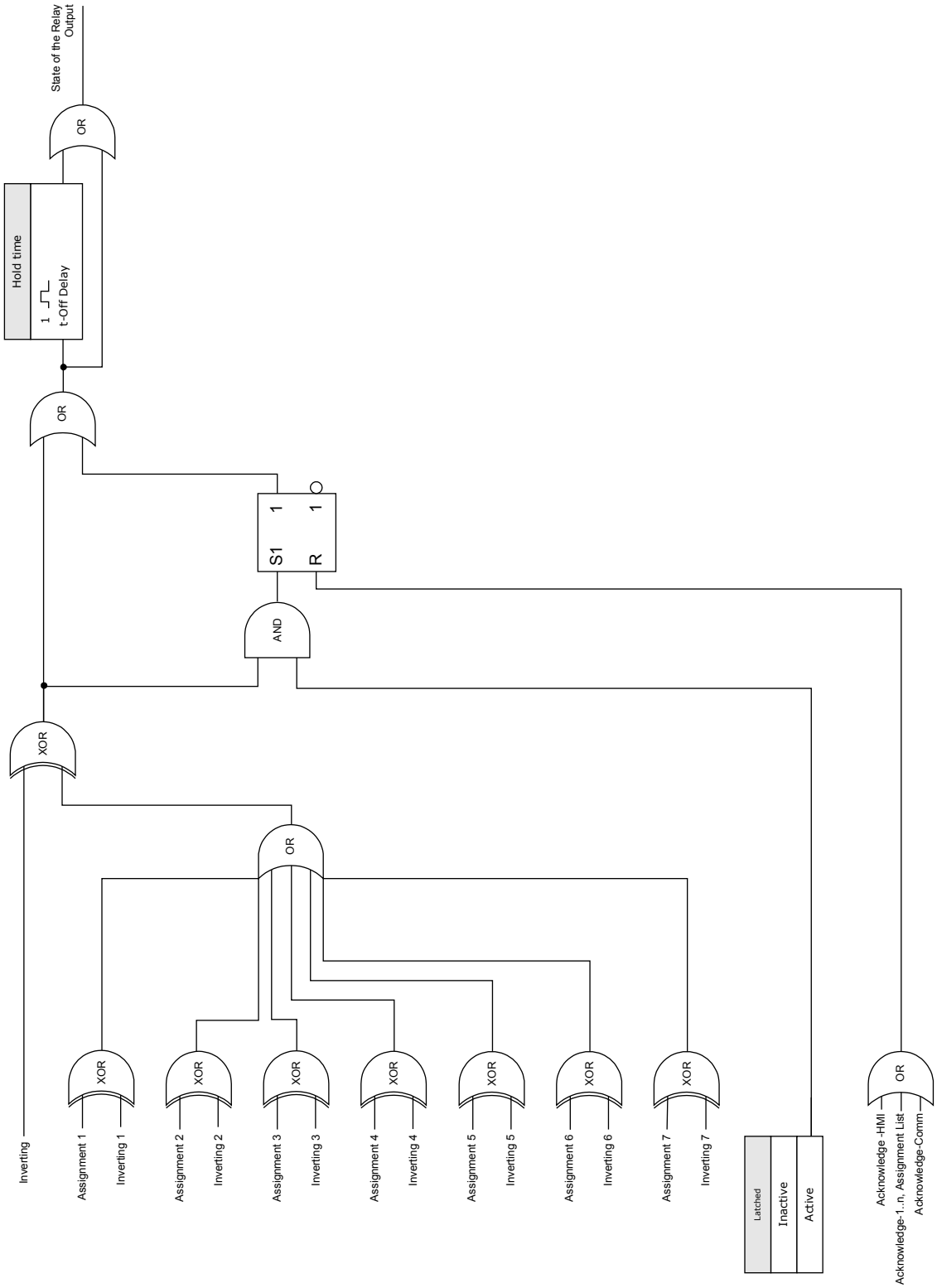
•Via the push-button »C« at the operating panel;

•Each relay output contact can be acknowledged by a signal (If »*Latched is active*«);

•Via the module »Ex Acknowledge« where all relay output contacts can be acknowledged at once if the signal for external acknowledgment that was selected from the »Assignment list« becomes true (e.g.: the state of a digital input); and

•Via Communication (Comm), all relay output contacts can be acknowledged at once.

WARNING **Relay output contacts can be set by force or disarmed (for commisioning support, please refer to the Service/Disarming the Relay Output Contacts and Service/Forcing the Relay Output Contacts sections).**



System Contact

The *System OK contact (SC relay)* is the devices »LIFE CONTACT«. Its installation location depends on the housing type. Please refer to the wiring diagram of the device (WDC-contact).

The *System-OK contact (SC relay)* cannot be configured. The system contact is a Form “C” contact that picks up when the device is free from internal faults. While the device is booting up, the *System OK relay (SC)* remains dropped-off (unenergized). As soon as the system is properly started, the System Contact picks up and the assigned LED is activated accordingly (please refer to the Self Supervision section).

Direct Commands of the Relay Output Contacts

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
DISARMED	This is the second step, after the "DISARM Ctrl" has been activated, that is required to DISARM the relay outputs. This will DISARM those relay outputs that are currently not latched and that are not on “hold” by a pending minimum hold time. CAUTION! RELAYS DISARMED in order to safely perform maintenance while eliminating the risk of taking an entire process off-line. (Note: Zone Interlocking and Supervision Contact cannot be disarmed). YOU MUST ENSURE that the relays are ARMED AGAIN after maintenance. Only available if: DISARMED Ctrl = Active	Inactive, Active	Inactive	[Service /Test /DISARMED /RO Slot X2]
Force all Outs	By means of this function the normal Relay Output State can be overwritten (forced). The relay can be set from normal operation (relay works according to the assigned signals) to "force energized" or "force de-energized" state. Forcing all relay outputs of an entire assembly group has precedence to forcing a single relay output.	Normal, De-Energized, Energized	Normal	[Service /Test /Force RO /RO Slot X2]
Force ZI RO	Signal: Forced Zone Interlocking OUT	Normal, De-Energized, Energized	Normal	[Service /Test /Force RO /RO Slot X2]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Force RO1	By means of this function the normal Relay Output State can be overwritten (forced). The relay can be set from normal operation (relay works according to the assigned signals) to "force energized" or "force de-energized" state.	Normal, De-Energized, Energized	Normal	[Service /Test /Force RO /RO Slot X2]
Force RO2	By means of this function the normal Relay Output State can be overwritten (forced). The relay can be set from normal operation (relay works according to the assigned signals) to "force energized" or "force de-energized" state.	Normal, De-Energized, Energized	Normal	[Service /Test /Force RO /RO Slot X2]
Force RO3	By means of this function the normal Relay Output State can be overwritten (forced). The relay can be set from normal operation (relay works according to the assigned signals) to "force energized" or "force de-energized" state.	Normal, De-Energized, Energized	Normal	[Service /Test /Force RO /RO Slot X2]
Force RO4	By means of this function the normal Relay Output State can be overwritten (forced). The relay can be set from normal operation (relay works according to the assigned signals) to "force energized" or "force de-energized" state.	Normal, De-Energized, Energized	Normal	[Service /Test /Force RO /RO Slot X2]

Global Protection Parameters of the Relay Output Contacts

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
t-Off Delay	To clearly identify the state transition of a Relay Output, the "new state" is being held, at least for the duration of the Off delay time.	0.00 - 300.00s	RO Slot X2: 0.2s RO Slot X5: 0.03s	[Device Para /Relay Outputs /RO Slot X2 /RO 1]
Latched	Defines whether the Relay Output will be latched when it picks up.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO Slot X2 /RO 1]
Acknowledgment	Acknowledgment Signal - An acknowledgment signal (that acknowledges the corresponding Relay Output) can be assigned to each Relay Output. The acknowledgement-signal is only effective if the parameter "Latched" is set to active. Only available if: Latched = Active	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO Slot X2 /RO 1]
Inverting	Inverting of the Relay Output.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO Slot X2 /RO 1]
Assignment 1	Assignment	1..n, Assignment List	RO Slot X2: Bkr[1].TripCmd RO Slot X5: -.-	[Device Para /Relay Outputs /RO Slot X2 /RO 1]
Inverting 1	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO Slot X2 /RO 1]
Assignment 2	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO Slot X2 /RO 1]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Inverting 2	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO Slot X2 /RO 1]
Assignment 3	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO Slot X2 /RO 1]
Inverting 3	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO Slot X2 /RO 1]
Assignment 4	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO Slot X2 /RO 1]
Inverting 4	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO Slot X2 /RO 1]
Assignment 5	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO Slot X2 /RO 1]
Inverting 5	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO Slot X2 /RO 1]
Assignment 6	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO Slot X2 /RO 1]
Inverting 6	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO Slot X2 /RO 1]
Assignment 7	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO Slot X2 /RO 1]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Inverting 7	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO Slot X2 /RO 1]
t-Off Delay	To clearly identify the state transition of a Relay Output, the "new state" is being held, at least for the duration of the Off delay time.	0.00 - 300.00s	RO Slot X2: 0.2s RO Slot X5: 0.03s	[Device Para /Relay Outputs /RO Slot X2 /RO 2]
Latched	Defines whether the Relay Output will be latched when it picks up.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO Slot X2 /RO 2]
Acknowledgment	Acknowledgment Signal - An acknowledgment signal (that acknowledges the corresponding Relay Output) can be assigned to each Relay Output. The acknowledgement-signal is only effective if the parameter "Latched" is set to active. Only available if: Latched = Active	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO Slot X2 /RO 2]
Inverting	Inverting of the Relay Output.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO Slot X2 /RO 2]
Assignment 1	Assignment	1..n, Assignment List	RO Slot X2: Bkr[2].TripCmd RO Slot X5: -.-	[Device Para /Relay Outputs /RO Slot X2 /RO 2]
Inverting 1	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO Slot X2 /RO 2]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Assignment 2	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO Slot X2 /RO 2]
Inverting 2	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO Slot X2 /RO 2]
Assignment 3	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO Slot X2 /RO 2]
Inverting 3	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO Slot X2 /RO 2]
Assignment 4	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO Slot X2 /RO 2]
Inverting 4	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO Slot X2 /RO 2]
Assignment 5	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO Slot X2 /RO 2]
Inverting 5	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO Slot X2 /RO 2]
Assignment 6	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO Slot X2 /RO 2]
Inverting 6	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO Slot X2 /RO 2]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Assignment 7	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO Slot X2 /RO 2]
Inverting 7	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO Slot X2 /RO 2]
t-Off Delay	To clearly identify the state transition of a Relay Output, the "new state" is being held, at least for the duration of the Off delay time.	0.00 - 300.00s	RO Slot X2: 0.2s RO Slot X5: 0.03s	[Device Para /Relay Outputs /RO Slot X2 /RO 3]
Latched	Defines whether the Relay Output will be latched when it picks up.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO Slot X2 /RO 3]
Acknowledgment	Acknowledgment Signal - An acknowledgment signal (that acknowledges the corresponding Relay Output) can be assigned to each Relay Output. The acknowledgement-signal is only effective if the parameter "Latched" is set to active. Only available if: Latched = Active	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO Slot X2 /RO 3]
Inverting	Inverting of the Relay Output.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO Slot X2 /RO 3]
Assignment 1	Assignment	1..n, Assignment List	RO Slot X2: 87.Trip RO Slot X5: -.-	[Device Para /Relay Outputs /RO Slot X2 /RO 3]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Inverting 1	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO Slot X2 /RO 3]
Assignment 2	Assignment	1..n, Assignment List	RO Slot X2: 87H.Trip RO Slot X5: -.-	[Device Para /Relay Outputs /RO Slot X2 /RO 3]
Inverting 2	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO Slot X2 /RO 3]
Assignment 3	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO Slot X2 /RO 3]
Inverting 3	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO Slot X2 /RO 3]
Assignment 4	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO Slot X2 /RO 3]
Inverting 4	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO Slot X2 /RO 3]
Assignment 5	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO Slot X2 /RO 3]
Inverting 5	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO Slot X2 /RO 3]
Assignment 6	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO Slot X2 /RO 3]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Inverting 6	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO Slot X2 /RO 3]
Assignment 7	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO Slot X2 /RO 3]
Inverting 7	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO Slot X2 /RO 3]
t-Off Delay	To clearly identify the state transition of a Relay Output, the "new state" is being held, at least for the duration of the Off delay time.	0.00 - 300.00s	0.03s	[Device Para /Relay Outputs /RO Slot X2 /RO 4]
Latched	Defines whether the Relay Output will be latched when it picks up.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO Slot X2 /RO 4]
Acknowledgment	Acknowledgment Signal - An acknowledgment signal (that acknowledges the corresponding Relay Output) can be assigned to each Relay Output. The acknowledgement-signal is only effective if the parameter "Latched" is set to active. Only available if: Latched = Active	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO Slot X2 /RO 4]
Inverting	Inverting of the Relay Output.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO Slot X2 /RO 4]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Assignment 1	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO Slot X2 /RO 4]
Inverting 1	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO Slot X2 /RO 4]
Assignment 2	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO Slot X2 /RO 4]
Inverting 2	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO Slot X2 /RO 4]
Assignment 3	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO Slot X2 /RO 4]
Inverting 3	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO Slot X2 /RO 4]
Assignment 4	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO Slot X2 /RO 4]
Inverting 4	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO Slot X2 /RO 4]
Assignment 5	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO Slot X2 /RO 4]
Inverting 5	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO Slot X2 /RO 4]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Assignment 6	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO Slot X2 /RO 4]
Inverting 6	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO Slot X2 /RO 4]
Assignment 7	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO Slot X2 /RO 4]
Inverting 7	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO Slot X2 /RO 4]
DISARMED Ctrl	Enables and disables the disarming of the relay outputs. This is the first step of a two step process, to inhibit the operation or the relay outputs. Please refer to "Disarm" for the second step.	Inactive, Active	Inactive	[Service /Test /DISARMED /RO Slot X2]
Disarm Mode	CAUTION! RELAYS DISARMED in order to safely perform maintenance while eliminating the risk of taking an entire process off-line. (Note: Zone Interlocking and Supervision Contact cannot be disarmed). YOU MUST ENSURE that the relays are ARMED AGAIN after maintenance.	Permanent, Timeout	Permanent	[Service /Test /DISARMED /RO Slot X2]
t-Timeout DISARM	The relays will be armed again after expiring of this time. Only available if: Mode = Timeout DISARM	0.00 - 300.00s	0.03s	[Service /Test /DISARMED /RO Slot X2]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Force Mode	By means of this function the normal Relay Output States can be overwritten (forced) in case that the Relay Output is not in a disarmed state. The relays can be set from normal operation (relay works according to the assigned signals) to "force energized" or "force de-energized" state.	Permanent, Timeout	Permanent	[Service /Test /Force RO /RO Slot X2]
t-Timeout Force	The Output State will be set by force for the duration of this time. That means, for the duration of this time, the Relay Output does not show the state of the signals that are assigned on it. Only available if: Mode = Timeout DISARM	0.00 - 300.00s	0.03s	[Service /Test /Force RO /RO Slot X2]

Input States of the Relay Output Contacts

Name	*Description*	*Assignment Via*
RO1.1	Module Input State: Assignment	[Device Para /Relay Outputs /RO Slot X2 /RO 1]
RO1.2	Module Input State: Assignment	[Device Para /Relay Outputs /RO Slot X2 /RO 1]
RO1.3	Module Input State: Assignment	[Device Para /Relay Outputs /RO Slot X2 /RO 1]
RO1.4	Module Input State: Assignment	[Device Para /Relay Outputs /RO Slot X2 /RO 1]
RO1.5	Module Input State: Assignment	[Device Para /Relay Outputs /RO Slot X2 /RO 1]
RO1.6	Module Input State: Assignment	[Device Para /Relay Outputs /RO Slot X2 /RO 1]
RO1.7	Module Input State: Assignment	[Device Para /Relay Outputs /RO Slot X2 /RO 1]
Ack signal RO 3	Module Input State: Acknowledgment signal for the Relay Output. If latching is set to active, the Relay Output can only be acknowledged if those signals that initiated the setting are fallen back and the hold time is expired.	[Device Para /Relay Outputs /RO Slot X2 /RO 1]
RO2.1	Module Input State: Assignment	[Device Para /Relay Outputs /RO Slot X2 /RO 2]

Name	*Description*	*Assignment Via*
RO2.2	Module Input State: Assignment	[Device Para /Relay Outputs /RO Slot X2 /RO 2]
RO2.3	Module Input State: Assignment	[Device Para /Relay Outputs /RO Slot X2 /RO 2]
RO2.4	Module Input State: Assignment	[Device Para /Relay Outputs /RO Slot X2 /RO 2]
RO2.5	Module Input State: Assignment	[Device Para /Relay Outputs /RO Slot X2 /RO 2]
RO2.6	Module Input State: Assignment	[Device Para /Relay Outputs /RO Slot X2 /RO 2]
RO2.7	Module Input State: Assignment	[Device Para /Relay Outputs /RO Slot X2 /RO 2]
Ack signal RO 4	Module Input State: Acknowledgment signal for the Relay Output. If latching is set to active, the Relay Output can only be acknowledged if those signals that initiated the setting are fallen back and the hold time is expired.	[Device Para /Relay Outputs /RO Slot X2 /RO 2]
RO3.1	Module Input State: Assignment	[Device Para /Relay Outputs /RO Slot X2 /RO 3]
RO3.2	Module Input State: Assignment	[Device Para /Relay Outputs /RO Slot X2 /RO 3]

Name	*Description*	*Assignment Via*
RO3.3	Module Input State: Assignment	[Device Para /Relay Outputs /RO Slot X2 /RO 3]
RO3.4	Module Input State: Assignment	[Device Para /Relay Outputs /RO Slot X2 /RO 3]
RO3.5	Module Input State: Assignment	[Device Para /Relay Outputs /RO Slot X2 /RO 3]
RO3.6	Module Input State: Assignment	[Device Para /Relay Outputs /RO Slot X2 /RO 3]
RO3.7	Module Input State: Assignment	[Device Para /Relay Outputs /RO Slot X2 /RO 3]
Ack signal RO 5	Module Input State: Acknowledgment signal for the Relay Output. If latching is set to active, the Relay Output can only be acknowledged if those signals that initiated the setting are fallen back and the hold time is expired.	[Device Para /Relay Outputs /RO Slot X2 /RO 3]
RO4.1	Module Input State: Assignment	[Device Para /Relay Outputs /RO Slot X2 /RO 4]
RO4.2	Module Input State: Assignment	[Device Para /Relay Outputs /RO Slot X2 /RO 4]
RO4.3	Module Input State: Assignment	[Device Para /Relay Outputs /RO Slot X2 /RO 4]

Name	*Description*	*Assignment Via*
RO4.4	Module Input State: Assignment	[Device Para /Relay Outputs /RO Slot X2 /RO 4]
RO4.5	Module Input State: Assignment	[Device Para /Relay Outputs /RO Slot X2 /RO 4]
RO4.6	Module Input State: Assignment	[Device Para /Relay Outputs /RO Slot X2 /RO 4]
RO4.7	Module Input State: Assignment	[Device Para /Relay Outputs /RO Slot X2 /RO 4]
Ack signal RO 6	Module Input State: Acknowledgment signal for the Relay Output. If latching is set to active, the Relay Output can only be acknowledged if those signals that initiated the setting are fallen back and the hold time is expired.	[Device Para /Relay Outputs /RO Slot X2 /RO 4]

Signals of the Relay Output Contacts

Name	*Description*
ZI OUT	Signal: Zone Interlocking OUT
RO 1	Signal: Relay Output
RO 2	Signal: Relay Output
RO 3	Signal: Relay Output
RO 4	Signal: Relay Output
DISARMED!	Signal: CAUTION! RELAYS DISARMED in order to safely perform maintenance while eliminating the risk of taking an entire process off-line. (Note: Zone Interlocking and Supervision Contact cannot be disarmed). YOU MUST ENSURE that the relays are ARMED AGAIN after maintenance
Outs forced	Signal: The State of at least one Relay Output has been set by force. That means that the state of at least one Relay is forced and hence does not show the state of the assined signals.

Light Emitting Diodes (LEDs)

LEDs group A ,LEDs group B

CAUTION

Attention must be paid to insure that there are no overlapping functions due to double or multiple LED assignment of colors and flashing codes.

CAUTION

If LEDs are configured as »Latched=*active*«, they will keep (return to) their blink code and color even if there is a power outage within the power supply of the protective device.

If the LEDs are configured as »Latched=*active*«, they will also retain their blink code and color even if the LEDs are reprogrammed in another way. This also applies if the LEDs are set to »Latched = ina*ctive*«. Resetting a LED that has latched a signal will always require an acknowledgement.

NOTICE

This chapter contains information on the LEDs that are placed on the left hand side of the display (Group A).

If your device is also equipped with LEDs on the right hand side of the display (Group B), the analog information in this chapter is valid. The only difference between "Group A" and "Group B" is within the menu paths.

Via the »INFO« push-button, it is always possible to display the current pickups and alarm texts that are assigned to an LED. Please refer to the *Navigation* section for a description of the »INFO« push-button functionality.

Set the following parameters for each LED.

•*»Latching (self holding function)«*: If *»Latching«* is set to *»Active«*, the state that is set by the pickups will be stored until it is reset. If *»Latching«* is set to *»Inactive«*, the LED always adopts the state of those pickups that were assigned.

•*»Acknowledgement«: S*ignal that will reset the LED.

•*»LED active color«*: LED lights up in this color when at least one of the allocated functions is valid (red, red-flashing, green, green flashing, off).

•*»LED inactive color«*: LED lights up in this color when none of the allocated functions is valid (red, red-flashing, green, green flashing, off).

•*»Assignment 1...n«* Apart from the *LED for System OK*, each LED can be assigned up to five functions (e.g. pickups) out of the »Assignment list«.

•*»Inverting an Assignment 1...n«:* This will invert the input signal.

Acknowledgment Options

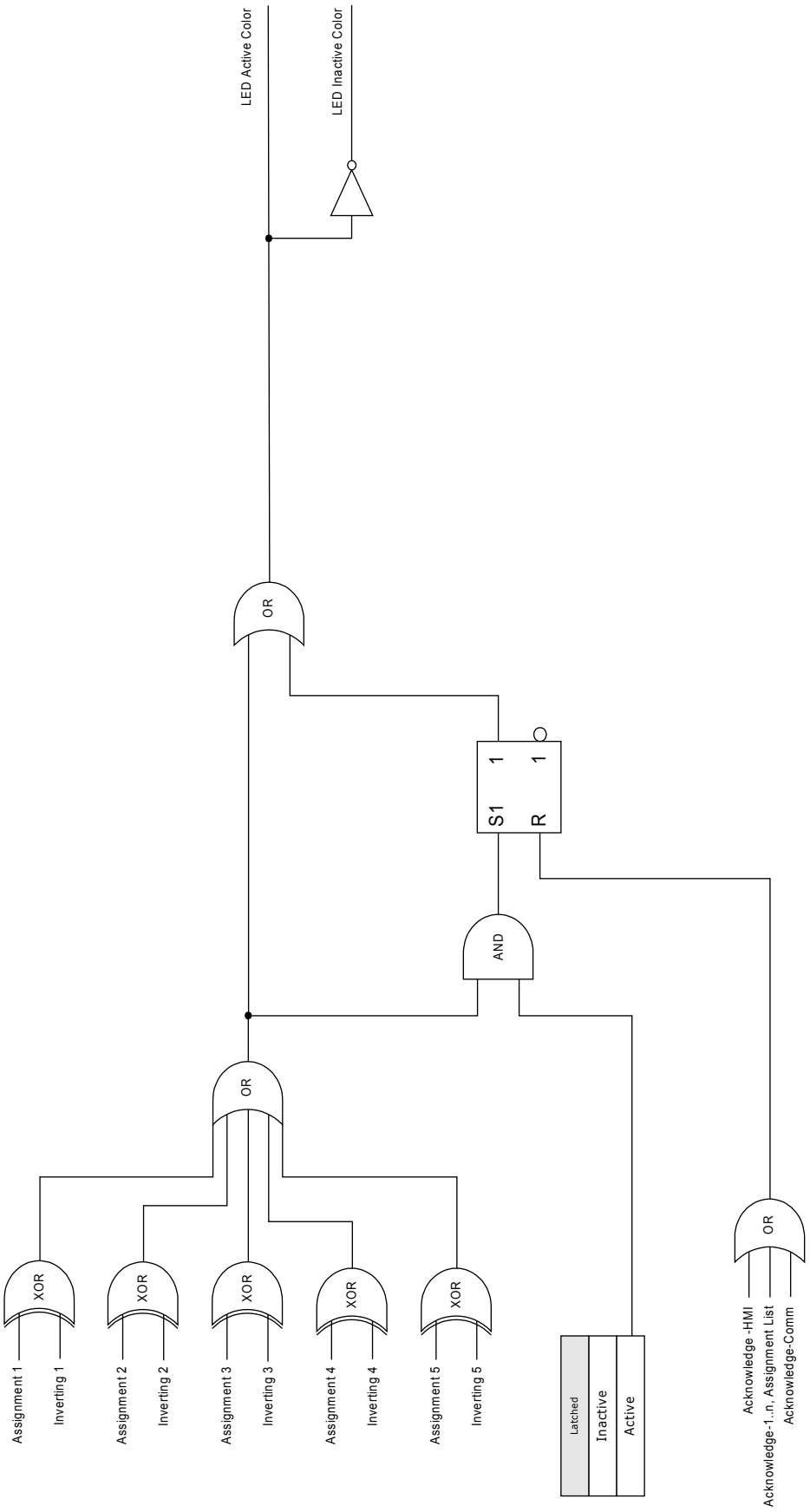
LEDs can be acknowledged by:

•The push-button »C« at the operating panel;

•A signal from the »LED Reset list« (e.g. Digital Inputs or Communication signals) (If »*Latched* = *active*«);

•The »Ex Acknowledge« module - all LEDs can be acknowledged at once, if the signal for external acknowledgment becomes true (e.g.: the state of a digital input); and

•Communication (Comm) - all LEDs can be acknowledged at once.


LED Active Color
LED Inactive Color
OR
S1
1
R
1
AND
OR
XOR
XOR
XOR
XOR
XOR
Assignment 1
Inverting 1
Assignment 2
Inverting 2
Assignment 3
Inverting 3
Assignment 4
Inverting 4
Assignment 5
Inverting 5
Latched
Inactive
Active
OR
Acknowledge -HMI
Acknowledge-1..n, Assignment List
Acknowledge-Comm

The »System OK« LED

This LED flashes green while the device is booting. After booting is complete, the LED for *System OK* lights up in green signaling that the *protection* (function) is »*activated*«. If, however, in spite of successful booting, or after the third unsuccessful reboot caused by the self supervision module, the *System OK – LED* flashes in red or is solidly illuminated in red, please contact your Eaton Corporation Customer Service Representative (also see the Self Supervision section).

The System OK LED cannot be configured.

Global Protection Parameters of the LED Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Latched	Defines whether the LED will be latched when it picks up.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 1]
Ack signal	Acknowledgment signal for the LED. If latching is set to active the LED can only be acknowledged if all signals that initiated the setting of the LED are no longer present. Dependency Only available if: Latched = Active	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 1]
LED Active Color	The LED lights up in this color if the state of the OR-assignment of the signals is true.	Green, Red, Red flash, Green flash, -	LEDs group A: Red flash LEDs group B: Red	[Device Para /LEDs /LEDs group A /LED 1]
LED Inactive Color	The LED lights up in this color if the state of the OR-assignment of the signals is false.	Green, Red, Red flash, Green flash, -	LEDs group A: - LEDs group B: Green	[Device Para /LEDs /LEDs group A /LED 1]
Assignment 1	Assignment	1..n, Assignment List	LEDs group A: 50P[1].Pickup LEDs group B: Bkr[1].Pos CLOSE	[Device Para /LEDs /LEDs group A /LED 1]
Inverting 1	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 1]
Assignment 2	Assignment	1..n, Assignment List	LEDs group A: 51P[1].Pickup LEDs group B: -.-	[Device Para /LEDs /LEDs group A /LED 1]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Inverting 2	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 1]
Assignment 3	Assignment	1..n, Assignment List	LEDs group A: 50R[1].Pickup LEDs group B: -.-	[Device Para /LEDs /LEDs group A /LED 1]
Inverting 3	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 1]
Assignment 4	Assignment	1..n, Assignment List	LEDs group A: 50R[1].Pickup LEDs group B: -.-	[Device Para /LEDs /LEDs group A /LED 1]
Inverting 4	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 1]
Assignment 5	Assignment	1..n, Assignment List	LEDs group A: 51Q[1].TripCmd LEDs group B: -.-	[Device Para /LEDs /LEDs group A /LED 1]
Inverting 5	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 1]
Latched	Defines whether the LED will be latched when it picks up.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 2]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Ack signal	Acknowledgment signal for the LED. If latching is set to active the LED can only be acknowledged if all signals that initiated the setting of the LED are no longer present. Only available if: Latched = Active	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 2]
LED Active Color	The LED lights up in this color if the state of the OR-assignment of the signals is true.	Green, Red, Red flash, Green flash, -	LEDs group A: Red flash LEDs group B: Red	[Device Para /LEDs /LEDs group A /LED 2]
LED Inactive Color	The LED lights up in this color if the state of the OR-assignment of the signals is false.	Green, Red, Red flash, Green flash, -	LEDs group A: - LEDs group B: Green	[Device Para /LEDs /LEDs group A /LED 2]
Assignment 1	Assignment	1..n, Assignment List	LEDs group A: 51P[3].Pickup LEDs group B: Bkr[2].Pos CLOSE	[Device Para /LEDs /LEDs group A /LED 2]
Inverting 1	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 2]
Assignment 2	Assignment	1..n, Assignment List	LEDs group A: 51X[2].Pickup LEDs group B: -.-	[Device Para /LEDs /LEDs group A /LED 2]
Inverting 2	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 2]
Assignment 3	Assignment	1..n, Assignment List	LEDs group A: 51R[2].Pickup LEDs group B: -.-	[Device Para /LEDs /LEDs group A /LED 2]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Inverting 3	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 2]
Assignment 4	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 2]
Inverting 4	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 2]
Assignment 5	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 2]
Inverting 5	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 2]
Latched	Defines whether the LED will be latched when it picks up.	Inactive, Active	LEDs group A: Active LEDs group B: Inactive	[Device Para /LEDs /LEDs group A /LED 3]
Ack signal	Acknowledgment signal for the LED. If latching is set to active the LED can only be acknowledged if all signals that initiated the setting of the LED are no longer present. Only available if: Latched = Active	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 3]
LED Active Color	The LED lights up in this color if the state of the OR-assignment of the signals is true.	Green, Red, Red flash, Green flash, -	LEDs group A: Red LEDs group B: Red flash	[Device Para /LEDs /LEDs group A /LED 3]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
LED Inactive Color	The LED lights up in this color if the state of the OR-assignment of the signals is false.	Green, Red, Red flash, Green flash, -	-	[Device Para /LEDs /LEDs group A /LED 3]
Assignment 1	Assignment	1..n, Assignment List	LEDs group A: 50P[1].Trip LEDs group B: 87.H2,H4,H5 Blo	[Device Para /LEDs /LEDs group A /LED 3]
Inverting 1	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 3]
Assignment 2	Assignment	1..n, Assignment List	LEDs group A: 51P[1].Trip LEDs group B: 87.Blo H2	[Device Para /LEDs /LEDs group A /LED 3]
Inverting 2	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 3]
Assignment 3	Assignment	1..n, Assignment List	LEDs group A: 50R[1].Trip LEDs group B: 87.Blo H4	[Device Para /LEDs /LEDs group A /LED 3]
Inverting 3	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 3]
Assignment 4	Assignment	1..n, Assignment List	LEDs group A: 51R[1].Trip LEDs group B: 87.Blo H5	[Device Para /LEDs /LEDs group A /LED 3]
Inverting 4	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 3]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Assignment 5	Assignment	1..n, Assignment List	LEDs group A: 51Q[2].TripCmd LEDs group B: -.-	[Device Para /LEDs /LEDs group A /LED 3]
Inverting 5	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 3]
Latched	Defines whether the LED will be latched when it picks up.	Inactive, Active	LEDs group A: Active LEDs group B: Inactive	[Device Para /LEDs /LEDs group A /LED 4]
Ack signal	Acknowledgment signal for the LED. If latching is set to active the LED can only be acknowledged if all signals that initiated the setting of the LED are no longer present. Only available if: Latched = Active	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 4]
LED Active Color	The LED lights up in this color if the state of the OR-assignment of the signals is true.	Green, Red, Red flash, Green flash, -	LEDs group A: Red LEDs group B: Red flash	[Device Para /LEDs /LEDs group A /LED 4]
LED Inactive Color	The LED lights up in this color if the state of the OR-assignment of the signals is false.	Green, Red, Red flash, Green flash, -	-	[Device Para /LEDs /LEDs group A /LED 4]
Assignment 1	Assignment	1..n, Assignment List	LEDs group A: 51P[3].Trip LEDs group B: 87.BlocH2	[Device Para /LEDs /LEDs group A /LED 4]
Inverting 1	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 4]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Assignment 2	Assignment	1..n, Assignment List	LEDs group A: 51X[2].Trip LEDs group B: -.-	[Device Para /LEDs /LEDs group A /LED 4]
Inverting 2	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 4]
Assignment 3	Assignment	1..n, Assignment List	LEDs group A: 51R[2].Trip LEDs group B: -.-	[Device Para /LEDs /LEDs group A /LED 4]
Inverting 3	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 4]
Assignment 4	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 4]
Inverting 4	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 4]
Assignment 5	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 4]
Inverting 5	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 4]
Latched	Defines whether the LED will be latched when it picks up.	Inactive, Active	LEDs group A: Active LEDs group B: Inactive	[Device Para /LEDs /LEDs group A /LED 5]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Ack signal	Acknowledgment signal for the LED. If latching is set to active the LED can only be acknowledged if all signals that initiated the setting of the LED are no longer present. Only available if: Latched = Active	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 5]
LED Active Color	The LED lights up in this color if the state of the OR-assignment of the signals is true.	Green, Red, Red flash, Green flash, -	LEDs group A: Red LEDs group B: Red flash	[Device Para /LEDs /LEDs group A /LED 5]
LED Inactive Color	The LED lights up in this color if the state of the OR-assignment of the signals is false.	Green, Red, Red flash, Green flash, -	-	[Device Para /LEDs /LEDs group A /LED 5]
Assignment 1	Assignment	1..n, Assignment List	LEDs group A: 87.Trip LEDs group B: 87.BlocH5	[Device Para /LEDs /LEDs group A /LED 5]
Inverting 1	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 5]
Assignment 2	Assignment	1..n, Assignment List	LEDs group A: 87H.Trip LEDs group B: -.-	[Device Para /LEDs /LEDs group A /LED 5]
Inverting 2	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 5]
Assignment 3	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 5]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Inverting 3	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 5]
Assignment 4	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 5]
Inverting 4	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 5]
Assignment 5	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 5]
Inverting 5	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 5]
Latched	Defines whether the LED will be latched when it picks up.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 6]
Ack signal	Acknowledgment signal for the LED. If latching is set to active the LED can only be acknowledged if all signals that initiated the setting of the LED are no longer present. Only available if: Latched = Active	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 6]
LED Active Color	The LED lights up in this color if the state of the OR-assignment of the signals is true.	Green, Red, Red flash, Green flash, -	LEDs group A: Red LEDs group B: Red flash	[Device Para /LEDs /LEDs group A /LED 6]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
LED Inactive Color	The LED lights up in this color if the state of the OR-assignment of the signals is false.	Green, Red, Red flash, Green flash, -	-	[Device Para /LEDs /LEDs group A /LED 6]
Assignment 1	Assignment	1..n, Assignment List	LEDs group A: -.- LEDs group B: RTD.Alarm	[Device Para /LEDs /LEDs group A /LED 6]
Inverting 1	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 6]
Assignment 2	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 6]
Inverting 2	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 6]
Assignment 3	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 6]
Inverting 3	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 6]
Assignment 4	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 6]
Inverting 4	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 6]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Assignment 5	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 6]
Inverting 5	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 6]
Latched	Defines whether the LED will be latched when it picks up.	Inactive, Active	LEDs group A: Active LEDs group B: Inactive	[Device Para /LEDs /LEDs group A /LED 7]
Ack signal	Acknowledgment signal for the LED. If latching is set to active the LED can only be acknowledged if all signals that initiated the setting of the LED are no longer present. Only available if: Latched = Active	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 7]
LED Active Color	The LED lights up in this color if the state of the OR-assignment of the signals is true.	Green, Red, Red flash, Green flash, -	LEDs group A: Red LEDs group B: Green flash	[Device Para /LEDs /LEDs group A /LED 7]
LED Inactive Color	The LED lights up in this color if the state of the OR-assignment of the signals is false.	Green, Red, Red flash, Green flash, -	-	[Device Para /LEDs /LEDs group A /LED 7]
Assignment 1	Assignment	1..n, Assignment List	LEDs group A: 87GD[2].Trip LEDs group B: Sys.Maint Mode Active	[Device Para /LEDs /LEDs group A /LED 7]
Inverting 1	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 7]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Assignment 2	Assignment	1..n, Assignment List	LEDs group A: 87GDH[2].Trip LEDs group B: -.-	[Device Para /LEDs /LEDs group A /LED 7]
Inverting 2	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 7]
Assignment 3	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 7]
Inverting 3	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 7]
Assignment 4	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 7]
Inverting 4	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 7]
Assignment 5	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 7]
Inverting 5	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 7]

LED Module Input States

Name	*Description*	*Assignment Via*
LED1.1	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 1]
LED1.2	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 1]
LED1.3	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 1]
LED1.4	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 1]
LED1.5	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 1]
Acknow Sig 1	Module Input State: Acknowledgment Signal (only for automatic acknowledgment).	[Device Para /LEDs /LEDs group A /LED 1]
LED2.1	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 2]
LED2.2	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 2]
LED2.3	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 2]

Name	*Description*	*Assignment Via*
LED2.4	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 2]
LED2.5	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 2]
Acknow Sig 2	Module Input State: Acknowledgment Signal (only for automatic acknowledgment).	[Device Para /LEDs /LEDs group A /LED 2]
LED3.1	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 3]
LED3.2	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 3]
LED3.3	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 3]
LED3.4	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 3]
LED3.5	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 3]
Acknow Sig 3	Module Input State: Acknowledgment Signal (only for automatic acknowledgment).	[Device Para /LEDs /LEDs group A /LED 3]
LED4.1	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 4]

Name	*Description*	*Assignment Via*
LED4.2	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 4]
LED4.3	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 4]
LED4.4	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 4]
LED4.5	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 4]
Acknow Sig 4	Module Input State: Acknowledgment Signal (only for automatic acknowledgment).	[Device Para /LEDs /LEDs group A /LED 4]
LED5.1	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 5]
LED5.2	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 5]
LED5.3	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 5]
LED5.4	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 5]
LED5.5	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 5]

Name	*Description*	*Assignment Via*
Acknow Sig 5	Module Input State: Acknowledgment Signal (only for automatic acknowledgment).	[Device Para /LEDs /LEDs group A /LED 5]
LED6.1	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 6]
LED6.2	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 6]
LED6.3	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 6]
LED6.4	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 6]
LED6.5	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 6]
Acknow Sig 6	Module Input State: Acknowledgment Signal (only for automatic acknowledgment).	[Device Para /LEDs /LEDs group A /LED 6]
LED7.1	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 7]
LED7.2	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 7]
LED7.3	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 7]

Name	*Description*	*Assignment Via*
LED7.4	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 7]
LED7.5	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 7]
Acknow Sig 7	Module Input State: Acknowledgment Signal (only for automatic acknowledgment).	[Device Para /LEDs /LEDs group A /LED 7]

URTD Module Interface

URTD

Principle – General Use

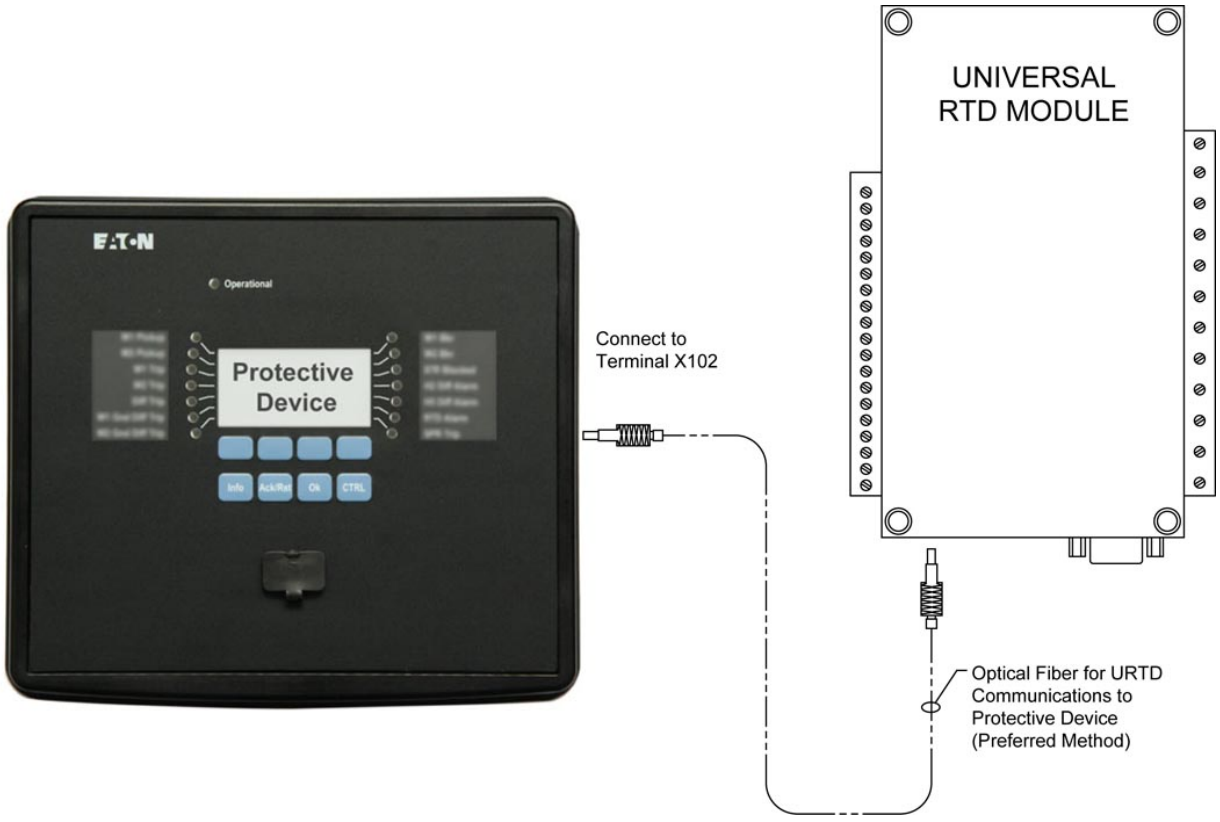
The optional Universal Resistance-based Temperature Detector (URTD) Module provides temperature data to the protective device from up to 11 RTDs embedded in the motor, generator, transformer, or cable connector and driven equipment (see Eaton I.L. 17367D). The temperature data will be shown as measured values and statistics in the Operating Data menu. In addition, each channel will be monitored. The measured data provided by the URTD Module can also be used for temperature protection (please refer to the Temperature Protection section).

The URTD conveys multiplexed temperature data back to the relay via a single optical fiber. The URTD may be mounted remotely from the protective device. The fiber optic connector is located on the **X102** terminal of the protective device.

Consider the benefit of mounting the URTD module away from the protective device and as close to the protected equipment as possible. The big bundle of RTD wires to the protected equipment becomes much shorter. The URTD may be placed up to 400 ft (121.9 m) from the protective device with the optical fiber connection. Note that the URTD will require 120 Vac power (6 VA) at its remote location.

URTD Module Fiber Optic Connection to the Protective Device

Connect a source of 120 Vac only to the power terminals of connector J3 on the URTD module. Connect either terminal 16 or terminal 32 (but not both) to a non-current-carrying safety ground.



The figure above shows the fiber optic connections between the URTD Module and the protective device. The protective device supports the optical fiber connection. The following table lists the fiber optic order options.

Fiber Optic Order Options.

Cutler-Hammer Agilent Technologies

Length	Catalog Number	Number
3.3 ft (1 m)	MPFO-1	HBFR-ELS001 or HBFRRLS001
16.4 ft (5 m)	MPFO-5	HBFR-ELS005 or HBFRRLS005
32.8 ft (10 m)	MPFO-10	HBFR-ELS010 or HBFRRLS010
82.0 ft (25 m)	MPFO-25	HBFR-ELS025
164.0 ft (50 m)	MPFO-50	HBFR-ELS050
246.1 ft (75 m)	MPFO-75	HBFR-ELS075
249.3 ft (76 m)	MPFO-76	HBFR-ELS076
328.1 ft (100 m)	MPFO-100	HBFR-ELS100
393.7 ft (120 m)	MPFO-120	HBFR-ELS120
Uncut Fiber	HBFR-EUS (Length)	

The optical fiber is the only method of transmitting temperature data from the URTD Module to the protective device.

Preassembled plastic optical fibers with connectors can be ordered from Eaton Cutler-Hammer, or from any distributor of Agilent Technologies® optical fiber products. In addition, these same distributors offer long rolls of cable with connectors that can be installed in the field. Some distributors will make custom lengths to order.

NOTICE

Force is 11 pounds (50 Newtons).

Surplus length of a pre-cut fiber does not cause a problems. Simply coil and tie the excess fiber at a convenient point. Avoid high tie pressure. Bending radius of the fiber should be greater than 2 in. (50.8 mm).

The fiber termination at the URTD simply snaps into or out of the connector. To connect the fiber termination at the protective device, push the plug of the fiber optic onto the device interface then turn it until it “snaps”.

CAUTION

The protective device has various power supply options. If it is not 120 Vac, the power supply cannot be shared with the URTD Module. The URTD communications common terminal 22 is at 120 Vac with respect to the supply neutral.

Wiring RTDs to the URTD Module

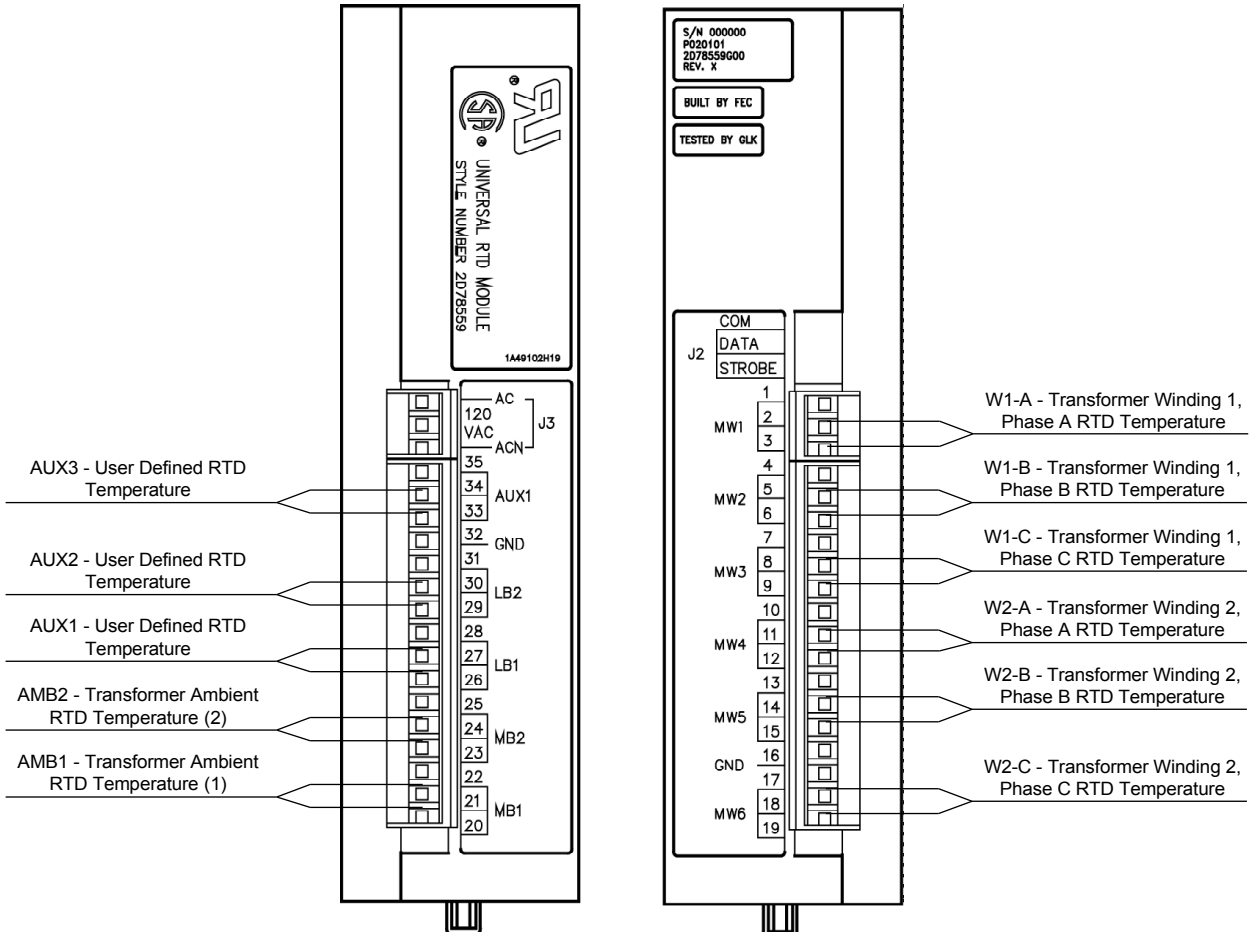
RTD Control	URTD Connection Name	Terminals	Transformer Temperature Monitoring Point
RTD1: Alarm Functional Trip Functional W1-A Alarm W1-A t-Delay W1-A Trip	MW1	2, 3	W1-A – Transformer Winding 1, Phase A RTD Temperature.
RTD2: Alarm Functional Trip Functional W1-B Alarm W1-B t-Delay W1-B Trip	MW2	5, 6	W1-B - Transformer Winding 1, Phase B RTD Temperature.
RTD3: Alarm Functional Trip Functional W1-C Alarm W1-C t-Delay W1-C Trip	MW3	8, 9	W1-C - Transformer Winding 1, Phase C RTD Temperature.
RTD4: Alarm Functional Trip Functional W2-A Alarm W2-A t-Delay W2-A Trip	MW4	11, 12	W2-A - Transformer Winding 2, Phase A RTD Temperature.
RTD5: Alarm Functional Trip Functional W2-B Alarm W2-B t-Delay W2-B Trip	MW5	14, 15	W2-B - Transformer Winding 2, Phase B RTD Temperature.
RTD6: Alarm Functional Trip Functional W2-C Alarm W2-C t-Delay W2-C Trip	MW6	18, 19	W2-C - Transformer Winding 2, Phase C RTD Temperature.
RTD7: Alarm Functional Trip Functional Amb1 Alarm Amb1 t-Delay Amb1 Trip	MB1	20, 21	AMB1 - Transformer Ambient RTD Temperature (1).
RTD8: Alarm Functional Trip Functional Amb2 Alarm Amb2 t-Delay Amb2 Trip	MB2	23, 24	AMB2 - Transformer Ambient RTD Temperature (2).
RTD9: Alarm Functional Trip Functional Aux1 Alarm Aux1 t-Delay Aux1 Trip	LB1	26, 27	AUX1 – User Defined RTD Temperature.

RTD Control	URTD Connection Name	Terminals	Transformer Temperature Monitoring Point
RTD10: Alarm Functional Trip Functional Aux2 Alarm Aux2 t-Delay Aux2 Trip	LB2	29, 30	AUX2 – User Defined RTD Temperature.
RTD11: Alarm Functional Trip Functional Aux3 Alarm Aux3 t-Delay Aux3 Trip	AUX1	33, 34	AUX3 – User Defined RTD Temperature.

NOTICE **Consult the URTD Module Instruction Leaflet (I.L. 17367D) for complete instructions.**

Three URTD terminals are provided for each RTD input.

The three terminals for any unused RTD input channel should be wired together. For example, if MW5 and MW6 are unused, MW5 terminals 13, 14, and 15 should be wired together and MW6 terminals 17, 18, and 19 should be separately wired together.



See the figure above for wiring of RTDs to the URTD inputs. Use #18 AWG, three-conductor shielded cable. Note the connection rules in the figure. When making connections to a two-lead RTD, connect two of the cable conductors to one of the RTD leads as shown. Make this connection as close to the transformer as possible. Connect the third cable conductor to the remaining RTD lead.

Connect the shield and drain wire, along with the one cable conductor, to the middle of the three RTD input channel terminals as shown in the figure. The RTD cable shield should be connected only at the URTD end, and insulated at the RTD end. The RTDs themselves must not be grounded at the object to be protected.

Remember to set the URTD module DIP switches according to the types of RTDs in each of the channels (see I.L. 17367D).

Device Planning Parameters of the URTD Module

Parameter	*Description*	*Options*	*Default*	*Menu Path*
Mode	Mode	Do not use, Use	Use	[Device Planning]

URTD Signals (Output States)

Name	*Description*
W1-A Superv	Signal: Supervision Channel W1-A
W1-B Superv	Signal: Supervision Channel W1-B
W1-C Superv	Signal: Supervision Channel W1-C
W2-A Superv	Signal: Supervision Channel W2-A
W2-B Superv	Signal: Supervision Channel W2-B
W2-C Superv	Signal: Supervision Channel W2-C
Amb1 Superv	Signal: Supervision Channel Amb1
Amb2 Superv	Signal: Supervision Channel Amb2
Aux1 Superv	Signal: Supervision Channel Aux1
Aux2 Superv	Signal: Supervision Channel Aux2
Aux3 Superv	Signal: Supervision Channel Aux3
Superv	Signal: URTD Supervision Channel
active	Signal: URTD active

URTD Module Statistics

Value	*Description*	*Menu Path*
W1-A max	Measured Value: Winding Temperature Maximum Value	[Operation /Statistics /URTD]
W1-A avg	Measured Value: Winding Temperature Average Value	[Operation /Statistics /URTD]
W1-A min	Measured Value: Winding Temperature Minimum Value	[Operation /Statistics /URTD]
W1-B max	Measured Value: Winding Temperature Maximum Value	[Operation /Statistics /URTD]
W1-B avg	Measured Value: Winding Temperature Average Value	[Operation /Statistics /URTD]
W1-B min	Measured Value: Winding Temperature Minimum Value	[Operation /Statistics /URTD]
W1-C max	Measured Value: Winding Temperature Maximum Value	[Operation /Statistics /URTD]
W1-C avg	Measured Value: Winding Temperature Average Value	[Operation /Statistics /URTD]
W1-C min	Measured Value: Winding Temperature Minimum Value	[Operation /Statistics /URTD]
W2-A max	Measured Value: Winding Temperature Maximum Value	[Operation /Statistics /URTD]
W2-A avg	Measured Value: Winding Temperature Average Value	[Operation /Statistics /URTD]
W2-A min	Measured Value: Winding Temperature Minimum Value	[Operation /Statistics /URTD]
W2-B max	Measured Value: Winding Temperature Maximum Value	[Operation /Statistics /URTD]

Value	*Description*	*Menu Path*
W2-B avg	Measured Value: Winding Temperature Average Value	[Operation /Statistics /URTD]
W2-B min	Measured Value: Winding Temperature Minimum Value	[Operation /Statistics /URTD]
W2-C max	Measured Value: Winding Temperature Maximum Value	[Operation /Statistics /URTD]
W2-C avg	Measured Value: Winding Temperature Average Value	[Operation /Statistics /URTD]
W2-C min	Measured Value: Winding Temperature Minimum Value	[Operation /Statistics /URTD]
Amb1 max	Measured Value: Ambient Temperature Maximum Value	[Operation /Statistics /URTD]
Amb1 avg	Measured Value: Ambient Temperature Average Value	[Operation /Statistics /URTD]
Amb1 min	Measured Value: Ambient Temperature Minimum Value	[Operation /Statistics /URTD]
Amb2 max	Measured Value: Ambient Temperature Maximum Value	[Operation /Statistics /URTD]
Amb2 avg	Measured Value: Ambient Temperature Average Value	[Operation /Statistics /URTD]
Amb2 min	Measured Value: Ambient Temperature Minimum Value	[Operation /Statistics /URTD]
Aux1 max	Measured Value: Auxiliary Temperature Maximum Value	[Operation /Statistics /URTD]
Aux1 avg	Measured Value: Auxiliary Temperature Average Value	[Operation /Statistics /URTD]

Value	*Description*	*Menu Path*
Aux1 min	Measured Value: Auxiliary Temperature Minimum Value	[Operation /Statistics /URTD]
Aux2 max	Measured Value: Auxiliary Temperature Maximum Value	[Operation /Statistics /URTD]
Aux2 avg	Measured Value: Auxiliary Temperature Average Value	[Operation /Statistics /URTD]
Aux2 min	Measured Value: Auxiliary Temperature Minimum Value	[Operation /Statistics /URTD]
Aux3 max	Measured Value: Auxiliary Temperature Maximum Value	[Operation /Statistics /URTD]
Aux3 avg	Measured Value: Auxiliary Temperature Average Value	[Operation /Statistics /URTD]
Aux3 min	Measured Value: Auxiliary Temperature Minimum Value	[Operation /Statistics /URTD]

URTD Measured Values

Value	*Description*	*Menu Path*
W1-A	Measured Value: Winding Temperature	[Operation /Measured Values /URTD]
W1-B	Measured Value: Winding Temperature	[Operation /Measured Values /URTD]
W1-C	Measured Value: Winding Temperature	[Operation /Measured Values /URTD]
W2-A	Measured Value: Winding Temperature	[Operation /Measured Values /URTD]
W2-B	Measured Value: Winding Temperature	[Operation /Measured Values /URTD]
W2-C	Measured Value: Winding Temperature	[Operation /Measured Values /URTD]
Amb1	Measured Value: Ambient Temperature	[Operation /Measured Values /URTD]
Amb2	Measured Value: Ambient Temperature	[Operation /Measured Values /URTD]
Aux1	Measured Value: Auxiliary Temperature	[Operation /Measured Values /URTD]
Aux2	Measured Value: Auxiliary Temperature	[Operation /Measured Values /URTD]
Aux3	Measured Value: Auxiliary Temperature	[Operation /Measured Values /URTD]

RTD Protection Module

Elements:
RTD

General – Principle Use

NOTICE

The Resistance-based Temperature Detector (RTD) Protection Module uses temperature data that are provided by Eaton's Universal Resistance-based Temperature Detector (URTD) module (please refer to the URTD Module section).

The protective device provides tripping and alarming functions based on the direct temperature measurements read from Eaton's (URTD) device that has 11 temperature sensor channels. Each channel will have one trip function without an intended delay and one alarm function with a delay.

•The "trip" function has only a threshold setting.

•Each individual »A*larm Function*« will have a threshold setting range, and can be individually enabled or disabled. Since the temperature cannot change instantaneously (which is a way that temperature differs from current), the "delay" is essentially built in to the function due to the fact that the temperature will take some time to increase from room temperature to the "trip threshold" level.

•The dropout ratio for both trip and alarm is 0.99.

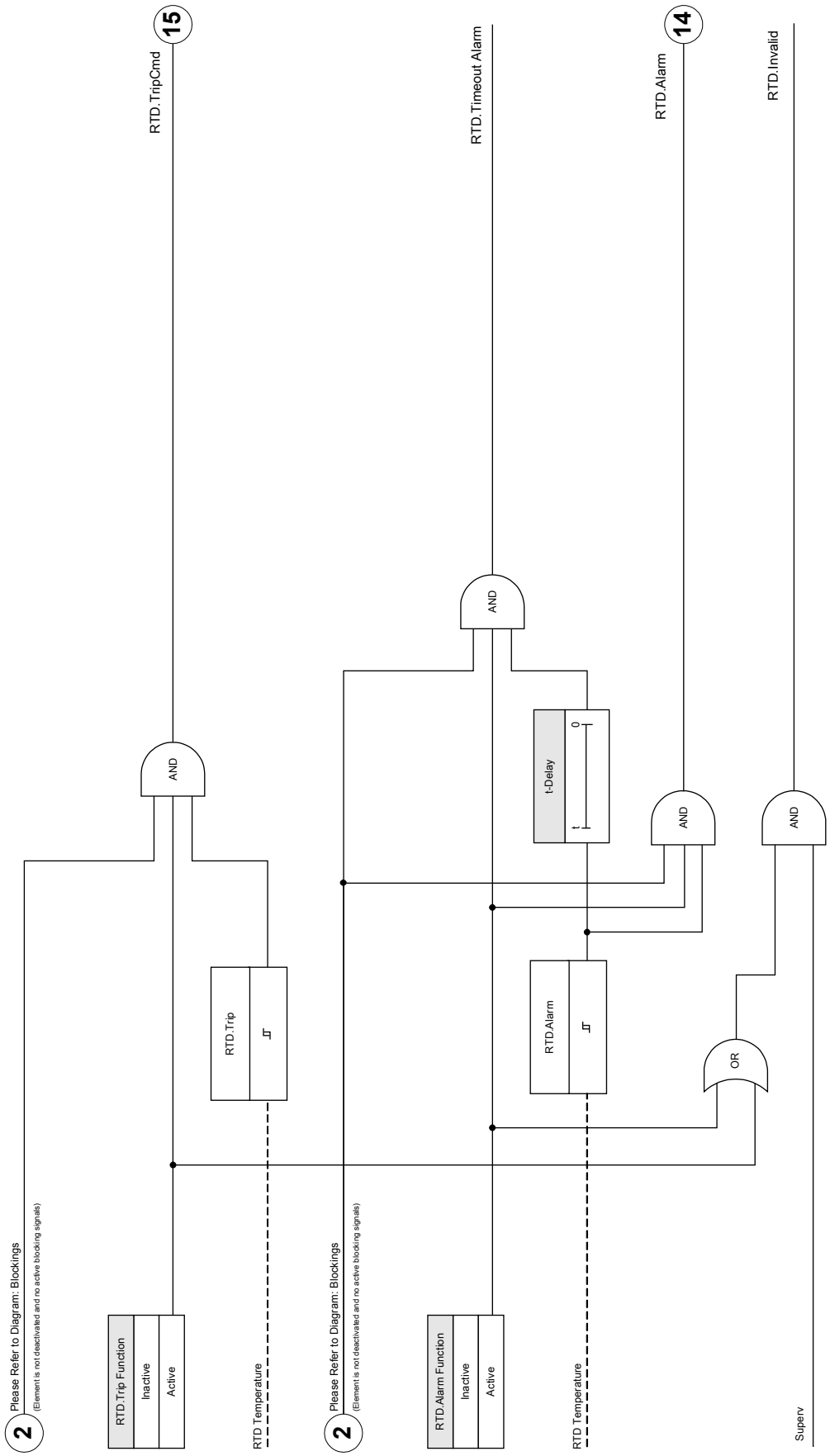
•
The temperature rise is limited by the RTD driver.

The entire function can be turned off or on, or individual channels can be turned off or on.

RTD

Each Channel (RTD):

W1-A, W1-B, W1-C, W2-A, W2-B,W2-C, Amb1, Amb2, Aux1, Aux2, Aux3



Device Planning Parameters of the RTD Module

Parameter	*Description*	*Options*	*Default*	*Menu Path*
Mode	Mode	Do not use, Use	Use	[Device Planning]

Global Protection Parameters of the RTD Temperature Protection Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Temp-Prot /RTD]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Temp-Prot /RTD]
ExBlo TripCmd	External blocking of the Trip Command of the module/the element, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Temp-Prot /RTD]

Setting Group Parameters of the RTD Temperature Protection Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Function	Permanent activation or deactivation of module/element.	Inactive, Active	Inactive	[Protection Para /<n> /Temp-Prot /RTD /General Settings]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /Temp-Prot /RTD /General Settings]
Blo TripCmd	Permanent blocking of the Trip Command of the module/element.	Inactive, Active	Inactive	[Protection Para /<n> /Temp-Prot /RTD /General Settings]
ExBlo TripCmd Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo TripCmd Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /Temp-Prot /RTD /General Settings]
Alarm Function	Resistance Temperature Detector 1 Alarm Function	Inactive, Active	Active	[Protection Para /<n> /Temp-Prot /RTD /RTD1]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Trip Function	Resistance Temperature Detector 1 Trip Function	Inactive, Active	Active	[Protection Para /<n> /Temp-Prot /RTD /RTD1]
W1-A Alarm	Winding1 Phase A Threshold for Temperature Alarm Only available if: Device Planning: Alarm Function = Use	0 - 200°C	105°C	[Protection Para /<n> /Temp-Prot /RTD /RTD1]
W1-A t-Delay	Winding1 Phase A If this time is expired a Temperature Alarm will be generated. Only available if: Device Planning: Alarm Function = Use	1 - 216000s	10s	[Protection Para /<n> /Temp-Prot /RTD /RTD1]
W1-A Trip	Winding1 Phase A Threshold for Temperature Trip Only available if: Device Planning: Trip Function = Use	0 - 200°C	110°C	[Protection Para /<n> /Temp-Prot /RTD /RTD1]
Alarm Function	Alarm Function	Inactive, Active	Active	[Protection Para /<n> /Temp-Prot /RTD /RTD2]
Trip Function	Trip Function	Inactive, Active	Active	[Protection Para /<n> /Temp-Prot /RTD /RTD2]
W1-B Alarm	Winding1 Phase B Threshold for Temperature Alarm Only available if: Device Planning: Alarm Function = Use	0 - 200°C	105°C	[Protection Para /<n> /Temp-Prot /RTD /RTD2]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
W1-B t-Delay	Winding1 Phase B If this time is expired a Temperature Alarm will be generated. Only available if: Device Planning: Alarm Function = Use	1 - 216000s	10s	[Protection Para /<n> /Temp-Prot /RTD /RTD2]
W1-B Trip	Winding1 Phase B Threshold for Temperature Trip Only available if: Device Planning: Trip Function = Use	0 - 200°C	110°C	[Protection Para /<n> /Temp-Prot /RTD /RTD2]
Alarm Function	Resistance Temperature Detector 3 Alarm Function	Inactive, Active	Active	[Protection Para /<n> /Temp-Prot /RTD /RTD3]
Trip Function	Resistance Temperature Detector 3 Trip Function	Inactive, Active	Active	[Protection Para /<n> /Temp-Prot /RTD /RTD3]
W1-C Alarm	Winding1 Phase C Threshold for Temperature Alarm Only available if: Device Planning: Alarm Function = Use	0 - 200°C	105°C	[Protection Para /<n> /Temp-Prot /RTD /RTD3]
W1-C t-Delay	Winding1 Phase C If this time is expired a Temperature Alarm will be generated. Only available if: Device Planning: Alarm Function = Use	1 - 216000s	10s	[Protection Para /<n> /Temp-Prot /RTD /RTD3]
W1-C Trip	Winding1 Phase C Threshold for Temperature Trip Only available if: Device Planning: Trip Function = Use	0 - 200°C	110°C	[Protection Para /<n> /Temp-Prot /RTD /RTD3]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Alarm Function	Alarm Function	Inactive, Active	Active	[Protection Para /<n> /Temp-Prot /RTD /RTD4]
Trip Function	Trip Function	Inactive, Active	Active	[Protection Para /<n> /Temp-Prot /RTD /RTD4]
W2-A Alarm	Winding2 Phase A Threshold for Temperature Alarm Only available if: Device Planning: Alarm Function = Use	0 - 200°C	105°C	[Protection Para /<n> /Temp-Prot /RTD /RTD4]
W2-A t-Delay	Winding2 Phase A If this time is expired a Temperature Alarm will be generated. Only available if: Device Planning: Alarm Function = Use	1 - 216000s	10s	[Protection Para /<n> /Temp-Prot /RTD /RTD4]
W2-A Trip	Winding2 Phase A Threshold for Temperature Trip Only available if: Device Planning: Trip Function = Use	0 - 200°C	110°C	[Protection Para /<n> /Temp-Prot /RTD /RTD4]
Alarm Function	Alarm Function	Inactive, Active	Active	[Protection Para /<n> /Temp-Prot /RTD /RTD5]
Trip Function	Trip Function	Inactive, Active	Active	[Protection Para /<n> /Temp-Prot /RTD /RTD5]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
W2-B Alarm	Winding2 Phase B Threshold for Temperature Alarm Only available if: Device Planning: Alarm Function = Use	0 - 200°C	105°C	[Protection Para /<n> /Temp-Prot /RTD /RTD5]
W2-B t-Delay	Winding2 Phase B If this time is expired a Temperature Alarm will be generated. Only available if: Device Planning: Alarm Function = Use	1 - 216000s	10s	[Protection Para /<n> /Temp-Prot /RTD /RTD5]
W2-B Trip	Winding2 Phase B Threshold for Temperature Trip Only available if: Device Planning: Trip Function = Use	0 - 200°C	110°C	[Protection Para /<n> /Temp-Prot /RTD /RTD5]
Alarm Function	Alarm Function	Inactive, Active	Active	[Protection Para /<n> /Temp-Prot /RTD /RTD6]
Trip Function	Trip Function	Inactive, Active	Active	[Protection Para /<n> /Temp-Prot /RTD /RTD6]
W2-C Alarm	Winding2 Phase C Threshold for Temperature Alarm Only available if: Device Planning: Alarm Function = Use	0 - 200°C	105°C	[Protection Para /<n> /Temp-Prot /RTD /RTD6]
W2-C t-Delay	Winding2 Phase C If this time is expired a Temperature Alarm will be generated. Only available if: Device Planning: Alarm Function = Use	1 - 216000s	10s	[Protection Para /<n> /Temp-Prot /RTD /RTD6]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
W2-C Trip	Winding2 Phase C Threshold for Temperature Trip Only available if: Device Planning: Trip Function = Use	0 - 200°C	110°C	[Protection Para /<n> /Temp-Prot /RTD /RTD6]
Alarm Function	Alarm Function	Inactive, Active	Active	[Protection Para /<n> /Temp-Prot /RTD /RTD7]
Trip Function	Trip Function	Inactive, Active	Active	[Protection Para /<n> /Temp-Prot /RTD /RTD7]
Amb1 Alarm	Ambient Threshold for Temperature Alarm Only available if: Device Planning: Alarm Function = Use	0 - 200°C	105°C	[Protection Para /<n> /Temp-Prot /RTD /RTD7]
Amb t-Delay1	Ambient If this time is expired a Temperature Alarm will be generated. Only available if: Device Planning: Alarm Function = Use	1 - 216000s	10s	[Protection Para /<n> /Temp-Prot /RTD /RTD7]
Amb1 Trip	Ambient Threshold for Temperature Trip Only available if: Device Planning: Trip Function = Use	0 - 200°C	110°C	[Protection Para /<n> /Temp-Prot /RTD /RTD7]
Alarm Function	Alarm Function	Inactive, Active	Active	[Protection Para /<n> /Temp-Prot /RTD /RTD8]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Alarm Function	Trip Function	Inactive, Active	Active	[Protection Para /<n> /Temp-Prot /RTD /RTD8]
Amb2 Alarm	Ambient Threshold for Temperature Alarm Only available if: Device Planning: Alarm Function = Use	0 - 200°C	105°C	[Protection Para /<n> /Temp-Prot /RTD /RTD8]
Amb t-Delay2	Ambient If this time is expired a Temperature Alarm will be generated. Only available if: Device Planning: Alarm Function = Use	1 - 216000s	10s	[Protection Para /<n> /Temp-Prot /RTD /RTD8]
Amb2 Trip	Ambient Threshold for Temperature Trip Only available if: Device Planning: Trip Function = Use	0 - 200°C	110°C	[Protection Para /<n> /Temp-Prot /RTD /RTD8]
Alarm Function	Alarm Function	Inactive, Active	Active	[Protection Para /<n> /Temp-Prot /RTD /RTD9]
Trip Function	Trip Function	Inactive, Active	Active	[Protection Para /<n> /Temp-Prot /RTD /RTD9]
Aux1 Alarm	Auxiliary Threshold for Temperature Alarm Only available if: Device Planning: Alarm Function = Use	0 - 200°C	105°C	[Protection Para /<n> /Temp-Prot /RTD /RTD9]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Aux1 t-Delay	Auxiliary If this time is expired a Temperature Alarm will be generated. Only available if: Device Planning: Alarm Function = Use	1 - 216000s	10s	[Protection Para /<n> /Temp-Prot /RTD /RTD9]
Aux1 Trip	Auxiliary Threshold for Temperature Trip Only available if: Device Planning: Trip Function = Use	0 - 200°C	110°C	[Protection Para /<n> /Temp-Prot /RTD /RTD9]
Alarm Function	Alarm Function	Inactive, Active	Active	[Protection Para /<n> /Temp-Prot /RTD /RTD10]
Trip Function	Trip Function	Inactive, Active	Active	[Protection Para /<n> /Temp-Prot /RTD /RTD10]
Aux2 Alarm	Auxiliary Threshold for Temperature Alarm Only available if: Device Planning: Alarm Function = Use	0 - 200°C	105°C	[Protection Para /<n> /Temp-Prot /RTD /RTD10]
Aux2 t-Delay	Auxiliary If this time is expired a Temperature Alarm will be generated. Only available if: Device Planning: Alarm Function = Use	1 - 216000s	10s	[Protection Para /<n> /Temp-Prot /RTD /RTD10]
Aux2 Trip	Auxiliary Threshold for Temperature Trip Only available if: Device Planning: Trip Function = Use	0 - 200°C	110°C	[Protection Para /<n> /Temp-Prot /RTD /RTD10]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Alarm Function	Alarm Function	Inactive, Active	Active	[Protection Para /<n> /Temp-Prot /RTD /RTD11]
Trip Function	Trip Function	Inactive, Active	Active	[Protection Para /<n> /Temp-Prot /RTD /RTD11]
Aux3 Alarm	Auxiliary Threshold for Temperature Alarm Only available if: Device Planning: Alarm Function = Use	0 - 200°C	105°C	[Protection Para /<n> /Temp-Prot /RTD /RTD11]
Aux3 t-Delay	Auxiliary If this time is expired a Temperature Alarm will be generated. Only available if: Device Planning: Alarm Function = Use	1 - 216000s	10s	[Protection Para /<n> /Temp-Prot /RTD /RTD11]
Aux3 Trip	Auxiliary Threshold for Temperature Trip Only available if: Device Planning: Trip Function = Use	0 - 200°C	110°C	[Protection Para /<n> /Temp-Prot /RTD /RTD11]

RTD Temperature Protection Module Input States

Name	*Description*	*Assignment Via*
ExBlo1-I	Module Input State: External Blocking1	[Protection Para /Global Prot Para /Temp-Prot /RTD]
ExBlo2-I	Module Input State: External Blocking2	[Protection Para /Global Prot Para /Temp-Prot /RTD]
ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command	[Protection Para /Global Prot Para /Temp-Prot /RTD]

RTD Temperature Protection Module Signals (Output States)

Name	*Description*
Active	Signal: Active
ExBlo	Signal: External Blocking
Blo TripCmd	Signal: Trip Command blocked
ExBlo TripCmd	Signal: External Blocking of the Trip Command
Alarm	Alarm RTD Temperature Protection
Trip	Signal: Trip
TripCmd	Signal: Trip Command
W1-A Trip	Winding1 Phase A Signal: Trip
W1-A Alarm	Winding1 Phase A Alarm RTD Temperature Protection
W1-A Timeout Alarm	Winding1 Phase A Timeout Alarm
W1-A Invalid	Winding1 Phase A Signal: Invalid Temperature Measurement Value (e.g caused by an defective or interuppted RTD Measurement)
W1-B Trip	Winding1 Phase B Signal: Trip
W1-B Alarm	Winding1 Phase B Alarm RTD Temperature Protection
W1-B Timeout Alarm	Winding1 Phase B Timeout Alarm
W1-B Invalid	Winding1 Phase B Signal: Invalid Temperature Measurement Value (e.g caused by an defective or interuppted RTD Measurement)
W1-C Trip	Winding1 Phase C Signal: Trip
W1-C Alarm	Winding1 Phase C Alarm RTD Temperature Protection
W1-C Timeout Alarm	Winding1 Phase C Timeout Alarm
W1-C Invalid	Winding1 Phase C Signal: Invalid Temperature Measurement Value (e.g caused by an defective or interuppted RTD Measurement)
W2-A Trip	Winding2 Phase A Signal: Trip
W2-A Alarm	Winding2 Phase A Alarm RTD Temperature Protection
W2-A Timeout Alarm	Winding2 Phase A Timeout Alarm
W2-A Invalid	Winding2 Phase A Signal: Invalid Temperature Measurement Value (e.g caused by an defective or interuppted RTD Measurement)
W2-B Trip	Winding2 Phase B Signal: Trip
W2-B Alarm	Winding2 Phase B Alarm RTD Temperature Protection
W2-B Timeout Alarm	Winding2 Phase B Timeout Alarm
W2-B Invalid	Winding2 Phase B Signal: Invalid Temperature Measurement Value (e.g caused by an defective or interuppted RTD Measurement)
W2-C Trip	Winding2 Phase C Signal: Trip
W2-C Alarm	Winding2 Phase C Alarm RTD Temperature Protection
W2-C Timeout Alarm	Winding2 Phase C Timeout Alarm
W2-C Invalid	Winding2 Phase C Signal: Invalid Temperature Measurement Value (e.g caused by an defective or interuppted RTD Measurement)
Amb 1 Trip	Ambient 1 Signal: Trip
Amb 1 Alarm	Ambient 1 Alarm RTD Temperature Protection
Amb 1 Timeout Alarm	Ambient 1 Timeout Alarm
Amb 1 Invalid	Ambient 1 Signal: Invalid Temperature Measurement Value (e.g caused by an defective or interuppted RTD Measurement)

Name	*Description*
Amb 2 Trip	Ambient 2 Signal: Trip
Amb 2 Alarm	Ambient 2 Alarm RTD Temperature Protection
Amb 2 Timeout Alarm	Ambient 2 Timeout Alarm
Amb 2 Invalid	Ambient 2 Signal: Invalid Temperature Measurement Value (e.g caused by an defective or interuppted RTD Measurement)
Aux 1 Trip	Auxiliary 1 Signal: Trip
Aux 1 Alarm	Auxiliary 1 Alarm RTD Temperature Protection
Aux 1 Timeout Alarm	Auxiliary 1 Timeout Alarm
Aux 1 Invalid	Auxiliary 1 Signal: Invalid Temperature Measurement Value (e.g caused by an defective or interuppted RTD Measurement)
Aux 2 Trip	Auxiliary 2 Signal: Trip
Aux 2 Alarm	Auxiliary 2 Alarm RTD Temperature Protection
Aux 2 Timeout Alarm	Auxiliary 2 Timeout Alarm
Aux 2 Invalid	Auxiliary 2 Signal: Invalid Temperature Measurement Value (e.g caused by an defective or interuppted RTD Measurement)
Aux 3 Trip	Auxiliary 3 Signal: Trip
Aux 3 Alarm	Auxiliary 3 Alarm RTD Temperature Protection
Aux 3 Timeout Alarm	Auxiliary 3 Timeout Alarm
Aux 3 Invalid	Auxiliary 4 Signal: Invalid Temperature Measurement Value (e.g caused by an defective or interuppted RTD Measurement)
Trip all Any Group	Trip all Any Group
Alarm all Any Group	Alarm all Any Group
Timeout Alarm all Any Group	Timeout Alarm all Any Group

Operating Panel (HMI)

HMI

Special Parameters of the Panel

The »Device Parameter/HMI« menu is used to define the contrast of the display, the maximum admissible edit time, and the menu language (after expiration, all unsaved parameter changes will be rejected).

Direct Commands of the Panel

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Contrast	Contrast	30 - 60	50	[Device Para /HMI]

Global Protection Parameters of the Panel

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
t-max Edit	If no other key(s) is pressed at the panel, after expiration of this time, all cached (changed) parameters are cancelled.	20 - 3600s	180s	[Device Para /HMI]

Module: Disturbance Recorder

Disturb rec

The disturbance recorder works with 32 samples per cycle. It can be started by one of eight start events (selection from the »Assignment list«/OR-Logic).

The disturbance record contains the measuring values including the pre-trigger time. By means of PowerPort-E*/Quality Manager* (option), the oscillographic curves of the analog (current, voltage) and digital channels/traces can be shown and evaluated in a graphical form.

The disturbance recorder has a storage capacity of 120 s (duration). The amount of records depends on the file size of each record.

The disturbance recorder can be configured in the*»Device Parameter/Recorder/Disturb rec«* menu.

Determine the maximum recording time to register a disturbance event. The maximum total length of a recording is 10 s (including pre-trigger and post-trigger time).

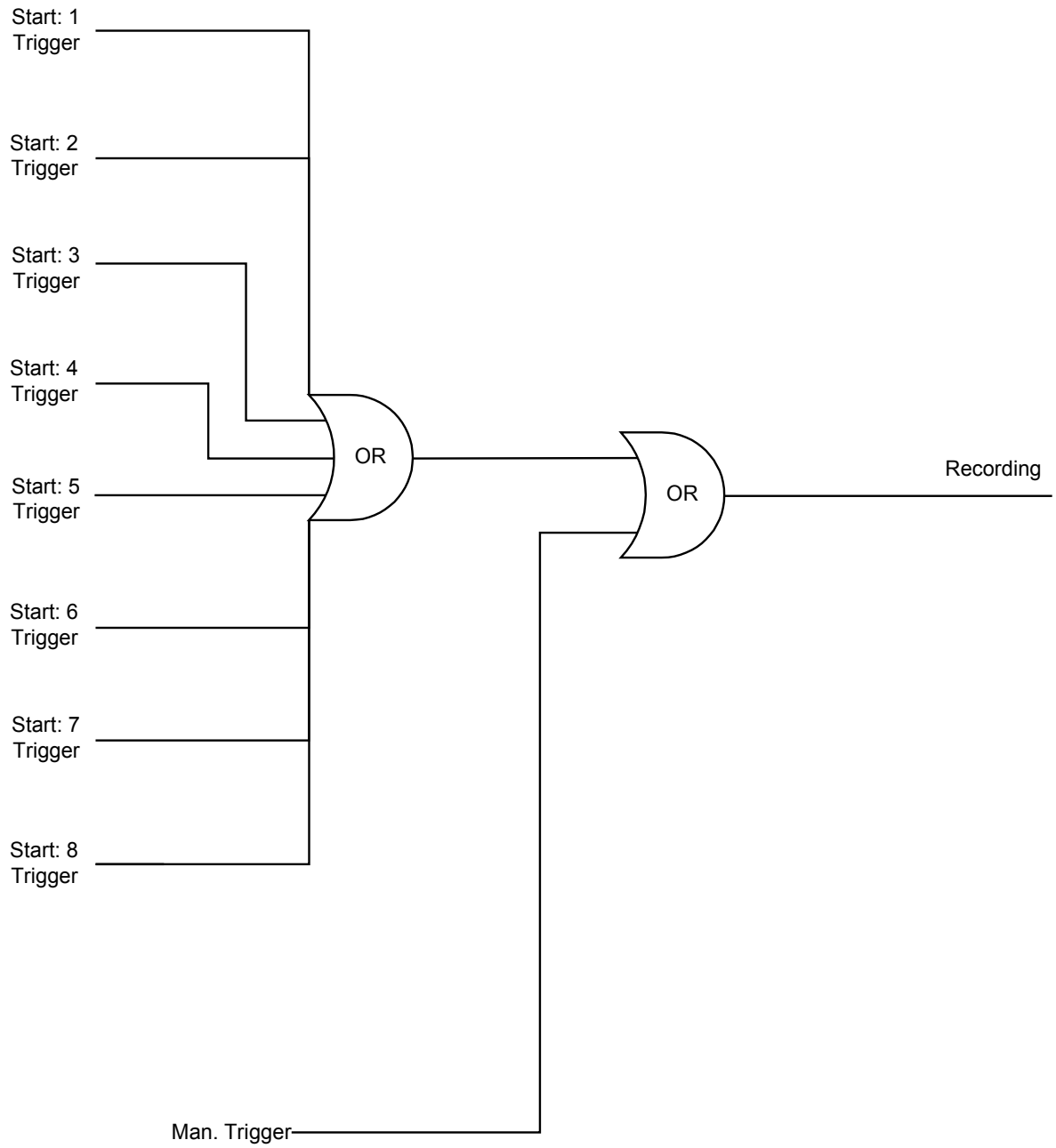
To trigger the disturbance recorder, up to eight signals can be selected from the »Assignment list«. The trigger events are OR-linked. If a disturbance record is written, a new disturbance record cannot be triggered until all trigger signals, which have triggered the previous disturbance record, are gone.

Recording is only done for the time the assigned event exists (event controlled), plus the time for the pre- and post-trigger, but not longer than 10 s. The time for the pre- and post trigger is to be entered as percent of the max. file size.

Example

The disturbance recorder is started by the general activation facility. After the fault has been cleared (+ follow-up time), the recording process is stopped (but after 10 s at the latest).

The parameter *»Auto Delete«* defines how the device will react if there is no saving place available. In case *»Auto Delete«* is *»Active«*, the first recorded disturbance will be overwritten according to the FIFO principle. If the parameter is set to *»Inactive«*, recording of the disturbance events will be stopped until the storage location is manually released.


Start: 1
Trigger
Start: 2
Trigger
Start: 3
Trigger
Start: 4
Trigger
Start: 5
Trigger
Start: 6
Trigger
Start: 7
Trigger
Start: 8
Trigger
OR
OR
Recording
Man. Trigger

Read Out Disturbance Records

Within the »Operation/Disturb rec« menu, the User can:

•Detect the accumulated disturbance records.

NOTICE **Within the »Operation/Recorders/Man Trigger« menu, the User can trigger the disturbance recorder manually.**

Disturbance Recorder to be Read Out by PowerPort-E

- If *PowerPort-E* is not running, please start the application.
- If the device data have not been loaded, click »Receive Data From The Device« in the »Device« menu.
- Double click the »Operation« icon in the navigation tree.
- Double click the »Recorders« icon in the navigation tree.
- Double click the »Disturb rec« icon.
- In the window, the disturbance records are shown in tabular form.
- A pop-up will be appear by a double click on a disturbance record. Choose a folder where the disturbance record is to be saved.
- The User can analyze the disturbance records by means of the optionally available *Quality Manager* by clicking on »Yes« when asked “Shall the received disturbance record be opened by the *Quality Manager?"*

Deleting Disturbance Records

Within the »Operation/Disturb rec« menu, the User can:

•Delete disturbance records;

•Choose the disturbance record that is to be deleted via »SOFTKEY« »up« and »SOFTKEY« »down«;

•Call up the detailed view of the disturbance record via »SOFTKEY« »right«;

•Confirm by pressing »SOFTKEY« »delete«;

•Enter the User password followed by pressing the »OK« key;

•Choose whether only the current or all disturbance records should be deleted; and

•Confirm by pressing »SOFTKEY« »OK«.

Deleting Disturbance Records Via PowerPort-E

- If *PowerPort-E* is not running, please start the application.
- If the device data have not been loaded, click »Receive Data From The Device« in the »Device« menu.
- Double click the »Operation« icon in the navigation tree.
- Double click the »Recorders« icon in the navigation tree.
- Double click the »Disturb rec« icon.
- In the window, the disturbance records are shown in tabular form.
- In order to delete a disturbance record, double click on:

  (the red x) in front of the disturbance record and confirm.

Direct Commands of the Disturbance Recorder Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Man. Trigger	Manual Trigger	False, True	False	[Operation /Recorders /Man. Trigger]
Reset all rec	Reset all records	Inactive, Active	Inactive	[Operation /Reset]

Global Protection Parameters of the Disturbance Recorder Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Start: 1	Start recording if the assigned signal is true.	1..n, Assignment List	Prot.Pickup	[Device Para /Recorders /Disturb rec]
Start: 2	Start recording if the assigned signal is true.	1..n, Assignment List	87.H2,H4,H5 Blo	[Device Para /Recorders /Disturb rec]
Start: 3	Start recording if the assigned signal is true.	1..n, Assignment List	-.-	[Device Para /Recorders /Disturb rec]
Start: 4	Start recording if the assigned signal is true.	1..n, Assignment List	-.-	[Device Para /Recorders /Disturb rec]
Start: 5	Start recording if the assigned signal is true.	1..n, Assignment List	-.-	[Device Para /Recorders /Disturb rec]
Start: 6	Start recording if the assigned signal is true.	1..n, Assignment List	-.-	[Device Para /Recorders /Disturb rec]
Start: 7	Start recording if the assigned signal is true.	1..n, Assignment List	-.-	[Device Para /Recorders /Disturb rec]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Start: 8	Start recording if the assigned signal is true.	1..n, Assignment List	-.-	[Device Para /Recorders /Disturb rec]
Auto overwriting	If there is no more free memory capacity left, the oldest file will be overwritten.	Inactive, Active	Active	[Device Para /Recorders /Disturb rec]
Follow-up time	Follow-up time	0 - 50%	20%	[Device Para /Recorders /Disturb rec]
Pre-trigger time	Pre-trigger time	0 - 50%	20%	[Device Para /Recorders /Disturb rec]
Max file size	Maximum duration of the record	0.1 - 10.0s	2s	[Device Para /Recorders /Disturb rec]

Disturbance Recorder Module Input States

Name	*Description*	*Assignment Via*
Start1-I	State of the module input: Trigger event / start recording if:	[Device Para /Recorders /Disturb rec]
Start2-I	State of the module input: Trigger event / start recording if:	[Device Para /Recorders /Disturb rec]
Start3-I	State of the module input: Trigger event / start recording if:	[Device Para /Recorders /Disturb rec]
Start4-I	State of the module input: Trigger event / start recording if:	[Device Para /Recorders /Disturb rec]
Start5-I	State of the module input: Trigger event / start recording if:	[Device Para /Recorders /Disturb rec]
Start6-I	State of the module input: Trigger event / start recording if:	[Device Para /Recorders /Disturb rec]
Start7-I	State of the module input: Trigger event / start recording if:	[Device Para /Recorders /Disturb rec]
Start8-I	State of the module input: Trigger event / start recording if:	[Device Para /Recorders /Disturb rec]

Disturbance Recorder Module Signals

Name	*Description*
Recording	Signal: Recording
Write err	Signal: Writing Error in Memory
Memory full	Signal: Memory Full
Clear fail	Signal: Clear Failure in Memory
Reset all rec	Signal: All records deleted
Reset record	Signal: Delete Record
Man. Trigger	Signal: Manual Trigger

Special Parameters of the Disturbance Recorder

Value	*Description*	*Default*	*Size*	*Menu Path*
Rec state	Recording state	Ready	Ready, Recording, Writing file, Trigger Blo	[Operation /Status display /Disturb rec]
Error code	Error code	OK	OK, Write err, Clear fail, Calculation err, File not found, Auto overwriting off	[Operation /Status display /Disturb rec]

Module: Fault Recorder

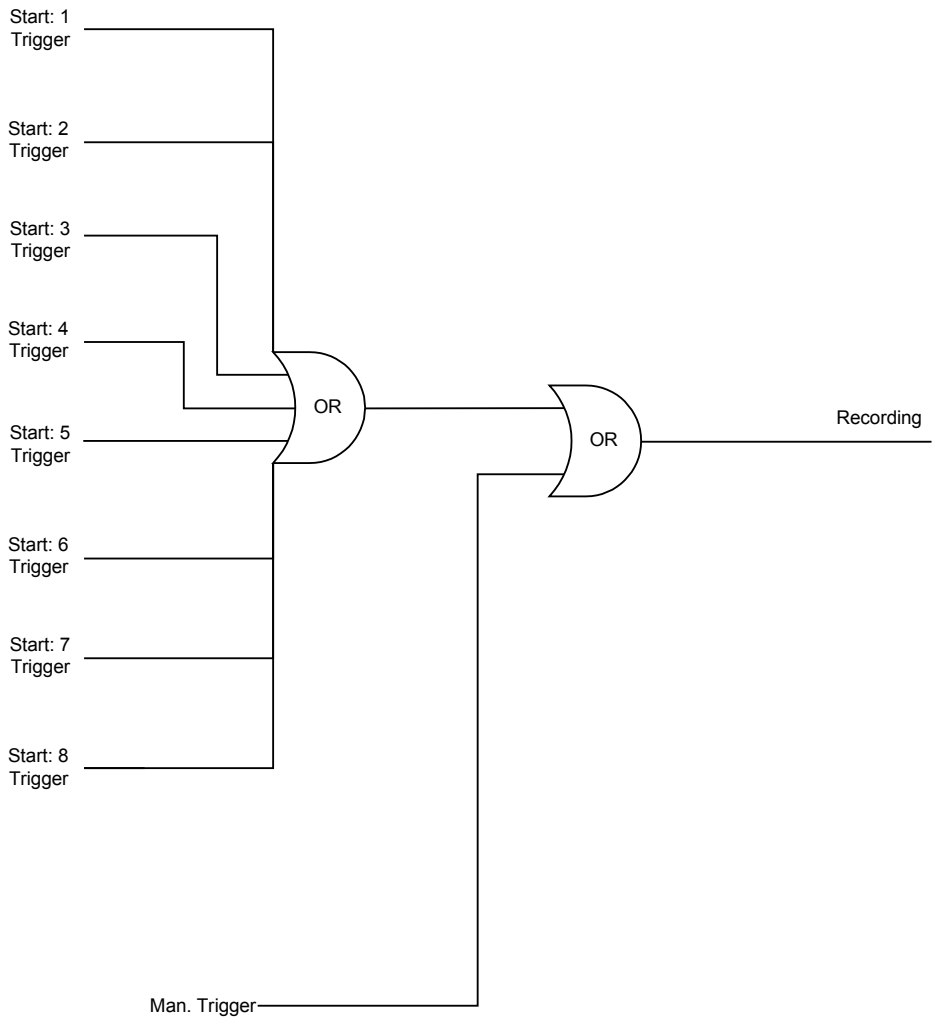
Fault rec

The fault recorder can be started by one of eight start events (selection from the »Assignment list«/OR-Logic). It can register up to 20 faults. The last of the recorded faults is stored in a fail-safe manner.

If one of the assigned trigger events becomes true, the fault recorder will be started. When a trigger event happens, each fault is saved including the module and name, fault number, number of grid faults and record number at that time. For each of the faults, the measuring values (at the time when the trigger event became true) can be viewed.

Up to eight signals to trigger the fault recorder can be selected from the »Assignment list«. The trigger events are OR-linked.

The parameter *»Auto Delete«* defines how the device will react if there is no saving place available. In case *»Auto Delete«* is *»Active«*, the first recorded fault will be overwritten according to the FIFO principle. If the parameter is set to *»Inactive«*, recording of the fault events will be stopped until the storage location is released manually.



Read Out the Fault Recorder

The measured values at the time of tripping are saved (fail safe) within the fault recorder. If there is no more memory free, the oldest record will be overwritten (FIFO).

In order to read out a failure record:

- Call up the main menu;
- Call up the sub-menu »Operation/Recorders/Fault rec.«;
- Select a fault record; and
- Analyze the corresponding measured values.

Read Out the Fault Recorder Via PowerPort-E

- If *PowerPort-E* is not running, please start the application.
- If the device data have not been loaded, click »Receive Data From The Device« in the »Device« menu.
- Double click the »Operation« icon in the navigation tree.
- Double click the »Fault Rec« icon within the »Operation/Recorders« tree.
- In the window, the fault recordings are shown in tabular form.
- In order to receive more detailed information on a fault, click the »Plus Sign« in front of the fault number.

NOTICE **Via the print menu, the User can export the data into a file. Please proceed as follows.**

• Call up the data as described above.

•Call up the »File/Print« menu.

•Choose »Print Actual Working Window« within the pop-up.

•Press the »Print« button.

•Press the »Export to File« button.

• Enter a file name.

• Choose a location where to save the file.

•Confirm the »Save« button.

Direct Commands of the Fault Recorder Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Reset all rec	Reset all records	Inactive, Active	Inactive	[Operation /Reset]
Man. Trigger	Manual Trigger	False, True	False	[Operation /Recorders /Man. Trigger]

Global Protection Parameters of the Fault Recorder Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Start: 1	Start recording if the assigned signal is true.	1..n, Assignment List	Prot.Trip	[Device Para /Recorders /Fault rec]
Start: 2	Start recording if the assigned signal is true.	1..n, Assignment List	-.-	[Device Para /Recorders /Fault rec]
Start: 3	Start recording if the assigned signal is true.	1..n, Assignment List	-.-	[Device Para /Recorders /Fault rec]
Start: 4	Start recording if the assigned signal is true.	1..n, Assignment List	-.-	[Device Para /Recorders /Fault rec]
Start: 5	Start recording if the assigned signal is true.	1..n, Assignment List	-.-	[Device Para /Recorders /Fault rec]
Start: 6	Start recording if the assigned signal is true.	1..n, Assignment List	-.-	[Device Para /Recorders /Fault rec]
Start: 7	Start recording if the assigned signal is true.	1..n, Assignment List	-.-	[Device Para /Recorders /Fault rec]
Start: 8	Start recording if the assigned signal is true.	1..n, Assignment List	-.-	[Device Para /Recorders /Fault rec]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Auto overwriting	If there is no more free memory capacity left, the oldest file will be overwritten.	Inactive, Active	Active	[Device Para /Recorders /Fault rec]

Fault Recorder Module Input States

Name	*Description*	*Assignment Via*
Start1-I	State of the module input: Trigger event / start recording if:	[Device Para /Recorders /Fault rec]
Start2-I	State of the module input: Trigger event / start recording if:	[Device Para /Recorders /Fault rec]
Start3-I	State of the module input: Trigger event / start recording if:	[Device Para /Recorders /Fault rec]
Start4-I	State of the module input: Trigger event / start recording if:	[Device Para /Recorders /Fault rec]
Start5-I	State of the module input: Trigger event / start recording if:	[Device Para /Recorders /Fault rec]
Start6-I	State of the module input: Trigger event / start recording if:	[Device Para /Recorders /Fault rec]
Start7-I	State of the module input: Trigger event / start recording if:	[Device Para /Recorders /Fault rec]
Start8-I	State of the module input: Trigger event / start recording if:	[Device Para /Recorders /Fault rec]

Fault Recorder Module Signals

Name	*Description*
Reset record	Signal: Delete Record
Man. Trigger	Signal: Manual Trigger

Module: Event Recorder

Event rec

The event recorder can register up to 300 events and the last (minimum) 50 saved events are fail-safe recorded. The following information is provided for any of the events.

Events are logged as follows:

Record No.	*Fault No.*	*Netfault No.*	*Date of Record*	*Module Name*	*State*
Sequential Number	Number of the ongoing fault. This counter will be incremented by each General Pickup (Prot.Pickup).	A Netfault No. can have several Fault Nos. This counter will be incremented by each General Pickup. (Exception AR: this applies only to devices that offer auto reclosing).	Time stamp	What has changed?	Changed Value

There are three different classes of events.

- ***Alternation of binary states are shown as:***
  - 0->1 if the signal changes physically from »0« to »1«.
  - 1->0 if the signal changes physically from »1« to »0«.
- ***Counters increment is shown as:***
  - Old Counter state -> New Counter state (e.g.: 3->4)
- ***Alternation of multiple states are shown as:***
  - Old state -> New state (e.g.: 0->2)

Read Out the Event Recorder

- Call up the »*main menu*«.
- Call up the sub-menu »*Operation/Recorders/Event rec*«.
- Select an event.

Read Out the Event Recorder via PowerPort-E

- If *PowerPort-E* is not running, please start the application.
- If the device data have not been loaded, click »Receive Data From The Device« in the »Device menu.
- Double click the »Operation« icon in the navigation tree.
- Double click the »Event Rec« icon within the »Operation/Recorders« menu.
- In the window, the events are shown in tabular form.

NOTICE

To have the event recorder up-dated in a cyclic manner, select »Automatic Up-Date« in the »*View*« menu.

PowerPort-E is able to record more events than the device itself, if the window of the event recorder is opened and »Automatic Up-Date« is set to active.

NOTICE **Via the print menu, the User can export the data into a file. Please proceed as follows.**

• Call up the data as described above.

•Call up the »File/Print« menu.

•Choose »Print Actual Working Window« within the pop-up.

•Press the »Print« button.

•Press the »Export to File« button.

• Enter a file name.

• Choose a location where to save the file.

•Confirm the »Save« button.

Direct Commands of the Event Recorder Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Reset all rec	Reset all records	Inactive, Active	Inactive	[Operation /Reset]

Event Recorder Module Signals

Name	*Description*
Reset all rec	Signal: All records deleted

Module: Modbus® (Modbus)

Modbus

Modbus® Protocol Configuration

The time-controlled Modbus® protocol is based on the Master-Slave working principle. This means that the substation control and protection system sends an inquiry or instruction to a certain device (slave address) that will then be answered or carried out accordingly. If the inquiry/instruction cannot be answered/carried out (e.g.: because of an invalid slave address), a failure message is returned to the master.

The Master (substation control and protection system) can query information from the device, such as:

- Type of unit version;
- Measuring values/statistical measured values;
- Switch operating position (in preparation);
- State of device;
- Time and date;
- State of the device's digital inputs; and
- Protection-/state pickups.

The Master (control system) can give commands/instructions to the device, such as:

- Control of switchgear (where applicable, i.e.: each according to the applied device version);
- Change-over of parameter set;
- Reset and acknowledgment of pickups/signals;
- Adjustment of the date and time; and
- Control of pickup relays.

For detailed information on data point lists and error handling, please refer to the Modbus® documentation.

To allow configuration of the devices for Modbus® connection, some default values of the control system must be available.

Device Planning Parameters of the Modbus

Parameter	*Description*	*Options*	*Default*	*Menu Path*
Mode	Mode	RTU, TCP	RTU	[Device Planning]

Modbus RTU

Part 1: Configuration of the Devices

Call up *»Device parameter/Modbus«* and set the following communication parameters:

- Slave-address, to allow clear identification of the device; and
- Baud rate.

Also, select the RS485 interface-related parameters such as:

- Number of data bits;
- One of the following supported communication variants: Number of data bits, even, odd, parity or no parity, number of stop bits;
- *»t-timeout«*: communication errors are only identified after expiry of a supervision time *»t-timeout«*; and
- Response time (defining the period within which an inquiry from the master has to be answered).

Part 2: Hardware Connection

- For hardware connection to the control system, there is an RS485 interface at the rear side of the device (RS485, fiber optic or terminals).
- Connect the bus and the device (wiring).
- Up to 32 devices can be connected to the bus (point to point connection/spurs).
- Connect a terminating resistor to the bus.

Error Handling - Hardware Errors

Information on physical communication errors, such as:

- Baud rate error and
- Parity error

can be obtained from the event recorder.

Error Handling – Errors on Protocol Level

If, for example, an invalid memory address is inquired, error codes will be returned by the device that need to be interpreted.

Modbus TCP

NOTICE

Establishing a connection via TCP/IP to the device is only possible if your device is equipped with an Ethernet Interface (RJ45).

Contact your IT administrator in order to establish the network connection.

Part 1: Setting the TCP/IP Parameters

Call up *»Device parameter/TCP/IP«* at the HMI (panel) and set the following parameters:

- TCP/IP address;
- Subnetmask; and
- Gateway.

Part 2: Configuration of the Devices

Call up *»Device parameter/Modbus«* and set the following communication parameters.

- Setting a Unit Identifier is only necessary if a TCP network should be coupled to a RTU network.
- If a different port than the default port 502 should be used please proceed as follows:
    - Choose “Private” within the TCP-Port-Configuration.
    - Set the port-number.
- Set the maximum acceptable time out for “no communication”. If this time has expired without any communication, the device concludes a failure has occurred within the master system.
- Allow or disallow the blocking of SCADA commands.

Part 3: Hardware Connection

- There is a RJ45 interface at the rear side of the device for the hardware connection to the control system.
- Establish the connection to the device by means of a proper Ethernet cable.

Direct Commands of the Modbus®

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Reset Diagn Cr	All Modbus Diagnosis Counters will be reset.	Inactive, Active	Inactive	[Operation /Reset]

Global Protection Parameters of the Modbus®

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Slave ID	Device address (Slave ID) within the bus system. Each device address has to be unique within a bus system. Only available if:Device Planning = RTU	1 - 247	1	[Device Para /Modbus]
Unit ID	The Unit Identifier is used for routing. This parameter is to be set, if a Modbus RTU and a Modbus TCP network should be coupled. Only available if:Device Planning = TCP	1 - 255	255	[Device Para /Modbus]
TCP Port Config	TCP Port Configuration. This parameter is to be set only if the default Modubs TCP Port should not be used. Only available if:Device Planning = TCP	Default, Private	Default	[Device Para /Modbus]
Port	Port number Only available if:Device Planning = TCP And Only available if: TCP Port Config = Private	502 - 65535	502	[Device Para /Modbus]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
t-timeout	Within this time the answer has to be received by the Communication system, otherwise the request will be disregarded. In that case, the Communication system detects a communication failure and the Communication System has to send a new request. Only available if:Device Planning = RTU	0.01 - 10.00s	1s	[Device Para /Modbus]
Baud rate	Baud rate Only available if:Device Planning = RTU	1200, 2400, 4800, 9600, 19200, 38400	19200	[Device Para /Modbus]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Physical Settings	Digit 1: Number of bits. Digit 2: E=even parity, O=odd parity, N=no parity. Digit 3: Number of stop bits. More information on the parity: It is possible that the last data bit is followed by a parity bit which is used for recognition of communication errors. The parity bit ensures that with even parity ("EVEN") always an even number of bits with valence "1" or with odd parity ("ODD") an odd number of "1" valence bits are transmitted. But it is also possible to transmit no parity bits (here the setting is "Parity = None"). More information on the stop-bits: The end of a data byte is terminated by the stop-bits. Only available if:Device Planning = RTU	8E1, 8O1, 8N1, 8N2	8E1	[Device Para /Modbus]
t-call	If there is no request message sent from Communication to the device after expiry of this time, the device concludes a communication failure within the Communication system.	1 - 3600s	10s	[Device Para /Modbus]
Comm CmdBlo	Activating (allowing)/ Deactivating (disallowing) the blocking of the Communication Commands	Inactive, Active	Inactive	[Device Para /Modbus]

Modbus® Module Signals (Output States)

NOTICE **Some signals (that are active for a short time only) have to be acknowledged separately (e.g.: trip signals) by the Communication System.**

Name	*Description*
Transmission	Signal: Communication Active
Comm Cmd 1	Communication Command
Comm Cmd 2	Communication Command
Comm Cmd 3	Communication Command
Comm Cmd 4	Communication Command
Comm Cmd 5	Communication Command
Comm Cmd 6	Communication Command
Comm Cmd 7	Communication Command
Comm Cmd 8	Communication Command
Comm Cmd 9	Communication Command
Comm Cmd 10	Communication Command
Comm Cmd 11	Communication Command
Comm Cmd 12	Communication Command
Comm Cmd 13	Communication Command
Comm Cmd 14	Communication Command
Comm Cmd 15	Communication Command
Comm Cmd 16	Communication Command

Modbus® Module Values

Value	*Description*	*Default*	*Size*	*Menu Path*
NoOfRequestsTotal	Total number of requests. Includes requests for other slaves.	0	0 - 9999999999	[Operation /Count and RevData /Modbus]
NoOfRequestsForMe	Total Number of requests for this slave.	0	0 - 9999999999	[Operation /Count and RevData /Modbus]
NoOfResponse	Total number of requests having been responded.	0	0 - 9999999999	[Operation /Count and RevData /Modbus]
NoOfResponsTimeOverruns	Total number of requests with exceeded response time. Physically corrupted Frame.	0	0 - 9999999999	[Operation /Count and RevData /Modbus]
NoOfOverrunErros	Total Number of Overrun Failures. Physically corrupted Frame.	0	0 - 9999999999	[Operation /Count and RevData /Modbus]
NoOfParityErrors	Total number of parity errors. Physically corrupted Frame.	0	0 - 9999999999	[Operation /Count and RevData /Modbus]
NoOfFrameErrors	Total Number of Frame Errors. Physically corrupted Frame.	0	0 - 9999999999	[Operation /Count and RevData /Modbus]
NoOfBreaks	Number of detected communication aborts	0	0 - 9999999999	[Operation /Count and RevData /Modbus]
NoOfQueryInvalid	Total Number of Request errors. Request could not be interpreted	0	0 - 9999999999	[Operation /Count and RevData /Modbus]
NoOfInternalError	Total Number of Internal errors while interpreting the request.	0	0 - 9999999999	[Operation /Count and RevData /Modbus]

Parameters

Parameter setting and planning can be done:

•Directly at the device; or

•By way of the *PowerPort-E* software application.

Parameter Definitions

Device Parameters

Device Parameters are part of the Device Parameter Tree. By modifying the Device Parameters the User may (depending on the type of device):

- Set Cutoff Levels;,
- Assign Digital Inputs,;Assign LEDs;
- Assign Acknowledgment Signals;,
- Configure Statistics;
- Adapt HMI Settings;
- Configure Recorders (Reports);
- Set Date and Time;
- Change Passwords; and/or
- Check the Version (Build) of the Device.

System Parameters

System Parameters are part of the Device Parameter Tree. System Parameters comprise the essential, basic settings of your switchboard such as rated frequency and transformer ratios.

Protection Parameters

Protection Parameters are part of the Device Parameter Tree. This Protection Parameters include the following.

- ***Global Protection Parameters are part of the Protection Parameters:*** All settings and assignments that are done within the Global Parameter Tree are valid independent of the Setting Groups. They have to be set only once. In addition, Global Protection Parameters include the parameters used for CB Management.

- ***The Parameter Setting Switch is part of the Protection Parameters:*** The User may either directly switch to a certain parameter setting group or determine the conditions for switching onto another parameter setting group.

- ***Setting Group Parameters are part of the Protection Parameters:*** By means of the Setting Group Parameters the User may individually adapt the protective device to the current conditions or grid conditions. The Setting Group Parameters may be individually set in each Settings group.

Device Planning Parameters

Device Planning Parameters are part of the Device Parameter Tree.

- ***Improving the Usability (Clarity):*** All protection modules that are currently unused can be hidden (switched to invisible) through Device Planning. In the Device Planning menu, the User can adapt the scope of functionality of the protective device exactly as needed. The user can improve the usability by hiding all modules that are currently not needed.

- ***Adapting the device to your application:*** For those modules that are needed, determine how they should be set up (e.g.: directional, non-directional, <, >...).

Direct Commands

Direct Commands are part of the Device Parameter Tree but ***NOT*** part of the parameter file. They will be executed directly (e.g.: Resetting of a Counter).

State of the Module Inputs

Module Inputs are part of the Device Parameter Tree. The State of the Module Input is context-dependent.

By means of the Module Inputs, information can be passed to and acted upon by the Modules. The user can assign Signals to ***Module Inputs***. The state of the signals that are assigned to an input can be viewed from the Status Display. Module Inputs can be identified by an ***„-I“*** at the end of the name.

Signals

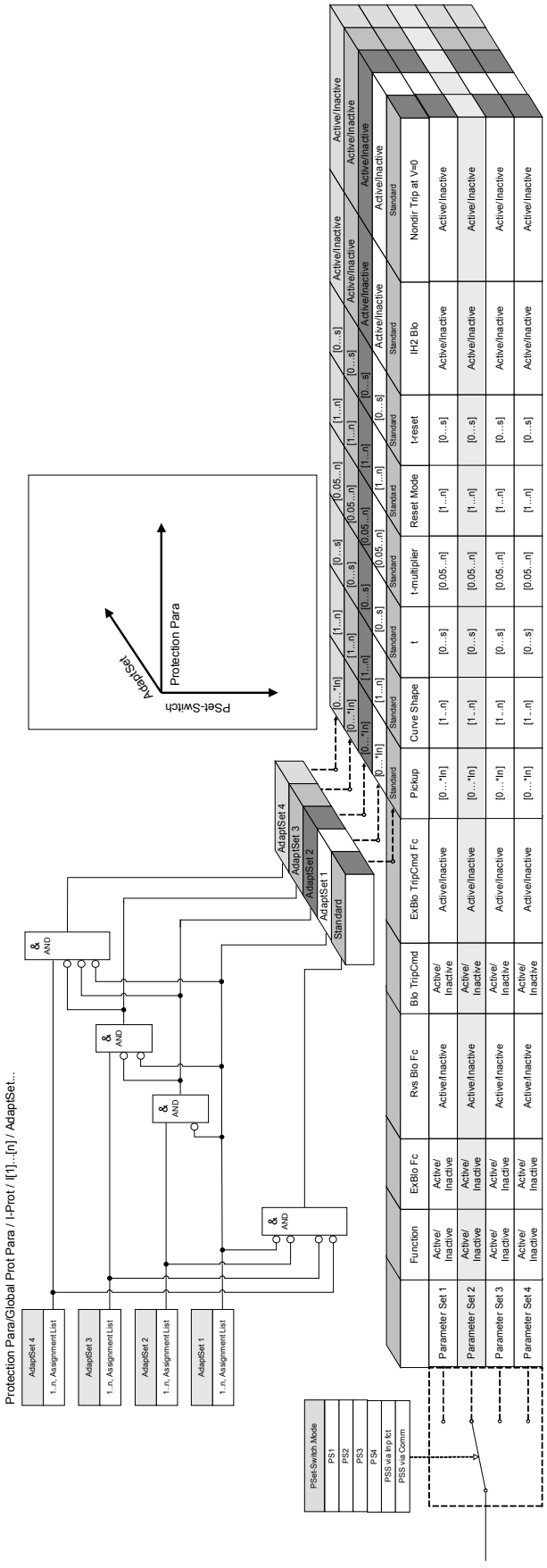
Signals are part of the Device Parameter Tree. The state of the signal is context-dependent.

- ***Signals*** represent the state of the installation/equipment (e.g.: Position Indicators of the Breaker).

- ***Signals*** are assessments of the state of the grid and the equipment (System OK, Transformer failure detected...).

- ***Signals*** represent decisions that are taken by the device (e.g.: Trip command) based on the user parameter settings.

Adaptive Parameter Sets



Adaptive Parameter Sets are part of the Device Parameter Tree.

By means of ***Adaptive Parameter Sets*** the user can temporarily modify single parameters within the Parameter Setting groups.

NOTICE

Adaptive Parameters fall back automatically, if the acknowledged signal that has activated them,has fallen back. Please take into account that Adaptive Set 1 is dominant to Adaptive Set 2. Adaptive Set 2 is dominant to Adaptive Set 3. Adaptive Set 3 is dominant to Adaptive Set 4.

NOTICE

In order to increase the usability (clarity), Adaptive Parameter Sets become visible if a corresponding activation signal has been assigned (PowerPort-E V. 1.2 and higher).

Example: In order to use Adaptive Parameters within Protective Element I[1] please proceed as follows.

- Assign within the Global Parameter tree, within Protective Element I[1], an activation signal for Adaptive Parameter Set 1.
- Adaptive Parameter Set 1 becomes now visible within the Protection Parameter Sets for element I[1].

By means of additional activation signals, further Adaptive Parameter Sets can be used.

The functionality of the IED (relay) can be enhanced / adapted by means of ***Adaptive Parameters*** in order to meet the requirements of modified states of the grid or the power supply system respectively to manage unpredictable events.

Moreover, the adaptive parameter can also be used to realize various special protective functions or to expand the existing function modules in a simple way without costly redesign the existing hardware or software platform.

The ***Adaptive Parameter*** feature allows, besides a standard parameter set, one of the four parameter sets labeled from 1 to 4, to be used for example in a time overcurrent element under the control of the configurable Set Control Logics. The dynamic switch-over of the adaptive parameter set is only active for a particular element when its adaptive set control logic is configured and only as long as the activation signal is true.

For some protection elements such as time overcurrent and instantaneous overcurrent (50P, 51P, 50G, 51G…), besides the “default” setting there exists another four “alternative” settings for pickup value, curve type, time dial, and reset mode set values that can dynamically be switched-over by means of the configurable adaptive setting control logics in the single set parameter.

If the ***Adaptive Parameter*** feature is not used, the adaptive set control logics will not be selected (assigned). The protective elements work in this case just like a normal protection using the “Default” settings. If one of the ***Adaptive Set*** Control logics is assigned to a logic function, the protective element will be “switched-over” to the corresponding adaptive settings if the assigned logic function is asserted and will fall back to the “Default” setting if the assigned signal that has activated the ***Adaptive Set*** has fallen back.

Adaptive Parameters via HMI

NOTICE **The use of Adaptive Parameters via the HMI (panel) differs a bit to the use via PowerPort-E.**

Adaptive Parameters can be also used via the HMI (instead of using the recommended *PowerPort-E*). The principle method of using them via the HMI is:

1. Assign an activation signal for an Adaptive Parameter Set within the Global Parameters »*Global Para*« for a protective element (available for current functions only).
2. Call up this protective element within a Setting Group.
3. Go to the parameter that should be modified adaptively and call it up for editing (arrow-right-key).
4. Choose the corresponding Adaptive Set.
5. Set the modified parameter for the selected Adaptive Set.

Application Example
The tripping time »*t*« for the *50[1]* element of »*Parameter Set 1*« should be desensitized (reduced) in case that Digital Input 2 becomes active.

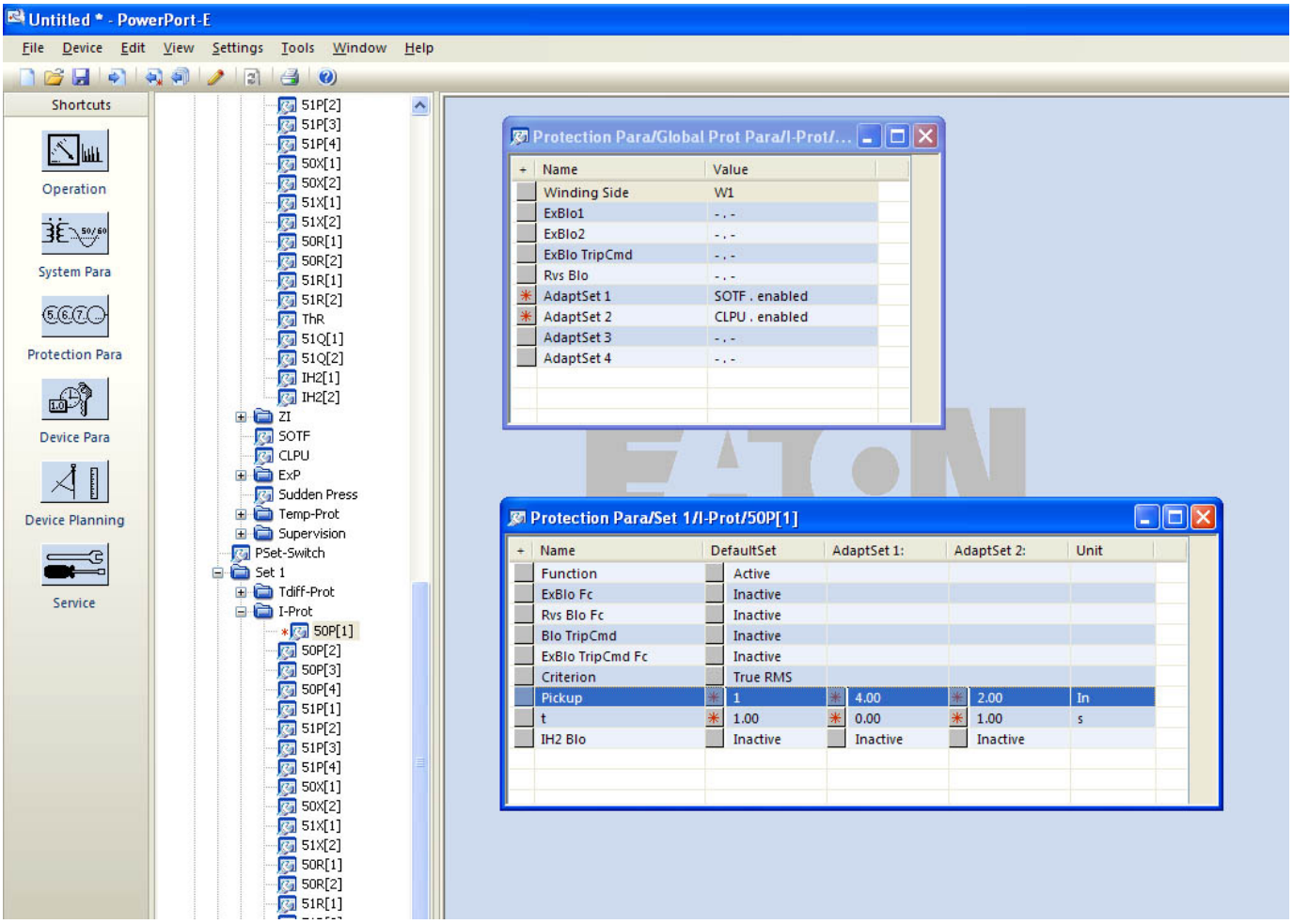
1. Call up the menu [Protection Para/Global Protection Para/I-Prot/50[1]/Adaptive Para1] and assign Digital Input 2 as activation signal.
2. Call up the *50[1]* element within the menu [Protection Para/Set[1]/I-Port/50[1].
3. Go to the tripping time parameter »*t*« by means of the softkey (arrow-down) and call up the submenu by means of the softkey (arrow-right).
4. Call up the corresponding parameter set (Adaptive Set 1 in this example).
5. Set the reduced tripping time for »*Adaptive Set 1*«.

Check and confirm via a commissioning test that the functionality is in compliance with your protection plan.

Application Example

During a “Switch-OnTo-Fault” condition, the User is usually requested to make the embedded protective function tripping of the faulted line faster, instantaneous, or sometimes non-directional.

Such a “Switch-OnTo-Fault” application can easily be realized using the ***Adaptive Parameter*** features mentioned previously. The standard time overcurrent protection element (e.g.: 51P) should trip instantaneously in case of *SOTF* condition,. If the *SOTF* logic function »SOTF ENABLED« is detecting a manual breaker close condition, the relay switches to ***Adaptive Set 1*** if the signal »SOTF.ENABLED« is assigned to ***Adaptive Set 1***. The corresponding ***Adaptive Set 1*** will become active and that »*t = 0*« sec.



The screen shot above shows the adaptive setting configurations following applications based on only one simple overcurrent protection element:

1. Standard Set: Default settings;
2. Adaptive Set 1: *SOTF* application (Switch-OnTo-Fault);
3. Adaptive Set 2: *CLPU* application (Cold Load Pickup);

Application Examples

- The output signal of the *Switch OnTo Fault* module can be used to activate an ***Adaptive Parameter Set*** that sensitizes the overcurrent protection.
- The output signal of the *Cold Load Pickup* module can be used to activate an ***Adaptive Parameter Set*** that desensitizes the overcurrent protection.
- By means of ***Adaptive Parameter Sets,*** an Adaptive *Auto Reclosure* can be realized. After a reclosure attempt, the tripping thresholds or tripping curves of the overcurrent protection can be adapted.
- Depending on undervoltage, the overcurrent protection can be modified (voltage controlled). This applies to devices that offer voltage protection only.
- The ground overcurrent protection can be modified by the residual voltage. This applies to devices that offer voltage protection only
- Dynamically and automatically adaption of the ground current settings in order to adapt the settings to different loads (single-phase load diversity).

NOTICE **Adaptive Parameter Sets are only available for devices with current protection modules.**

Adaptive Parameter Set Activation Signals

Name	*Description*
-.-	No assignment
IH2[1].Blo Phase A	Signal: Blocked Phase A
IH2[1].Blo Phase B	Signal: Blocked Phase B
IH2[1].Blo Phase C	Signal: Blocked Phase C
IH2[1].Blo IG	Signal: Blocking of the Earth Protection Module
IH2[2].Blo Phase A	Signal: Blocked Phase A
IH2[2].Blo Phase B	Signal: Blocked Phase B
IH2[2].Blo Phase C	Signal: Blocked Phase C
IH2[2].Blo IG	Signal: Blocking of the Earth Protection Module
SOTF.enabled	Signal: Switch Onto Fault enabled. This Signal can be used to modify Overcurrent Protection Settings.
CLPU.enabled	Signal: Cold Load enabled
ExP[1].Alarm	Signal: Alarm
ExP[2].Alarm	Signal: Alarm
ExP[3].Alarm	Signal: Alarm
ExP[4].Alarm	Signal: Alarm
Sudden Press.Alarm	Signal: Alarm
Ext Oil Temp.Alarm	Signal: Alarm
Ext Temp Superv[1].Alarm	Signal: Alarm
Ext Temp Superv[2].Alarm	Signal: Alarm
Ext Temp Superv[3].Alarm	Signal: Alarm
DI Slot X1.DI 1	Signal: Digital Input
DI Slot X1.DI 2	Signal: Digital Input
DI Slot X1.DI 3	Signal: Digital Input
DI Slot X1.DI 4	Signal: Digital Input
DI Slot X1.DI 5	Signal: Digital Input
DI Slot X1.DI 6	Signal: Digital Input
DI Slot X1.DI 7	Signal: Digital Input
DI Slot X1.DI 8	Signal: Digital Input
Sys.Maint Mode Active	Signal: Arc Flash Reduction Maintenance Active
Sys.Maint Mode Inactive	Signal: Arc Flash Reduction Maintenance Inactive

Operational Modes (Access Authorization)

Operational Mode – »Display Only«

•The protection is activated.

•All data, measuring values, records and counters/meters can be viewed.

Operation Mode – »Parameter Setting and Planning«

In this mode, the User is able to:

•Edit and set parameters;

•Change device planning details; and

•Configure and reset operational data (event recorder/fault recorder/power meter/switching cycles).

NOTICE **If the device was not active within the parameter setting mode for a longer time (can be set between 20 – 3600 seconds), the device will automatically reset to »Display Only« mode. (Please refer to the Appendix *Module Panel*).**

NOTICE **As long as the User is within the parameter setting mode, the device cannot acknowledge.**

In order to change into the operation mode (»Parameter Setting«) please proceed as follows.

1. Mark in the device display the parameter you want to change.

2. Press the »Wrench« soft key to temporarily change into the Parameter Setting mode.

3. Enter the parameter password.

4. Change the parameter.

5. Change any additional parameters that are needed.

NOTICE **As long as the User is within the parameter setting mode, a wrench icon will be shown in the upper right corner of the display.**

6. For saving the altered parameter(s):

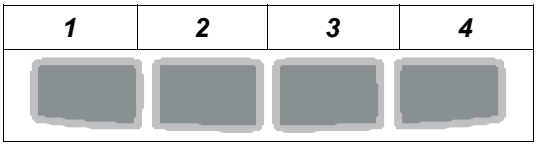
•Press the »OK« key; and
•Confirm by pressing the »Yes« soft key.

7. Then the device changes into the »Display Only« mode.

Password

Password Entry at the Panel

Passwords can be entered by way of the soft keys



Example: For password (3244) press successively:

•Soft key 3;
•Soft key 2;
•Soft key 4; and
•Soft key 4.

Password Changes

Passwords can be changed at the device in the »Device Para/Password« menu or by means of the *PowerPort-E* software.

NOTICE **A password must be a User-defined combination of the numerics 1, 2, 3, and 4.**

All other characters and keys WILL NOT be accepted.

The password for the operation mode »Parameter setting and planning« enables the User to transfer parameters from the *PowerPort-E* software into the device.

When the User wants to change a password, the existing one has to be entered first. The new password (up to 8 digits) is then to be confirmed twice. Please proceed as follows.

•In order to change the password, please enter the old password followed by pressing the »OK«-key.

•Next, enter the new password and press the »OK« key.

•Finally, confirm your new password and press the »OK« key.

Password Forgotten

All passwords can be reset to the fail-safe adjustment (1234) by pressing the »Ack/Rst« key during cold booting. For this procedure confirm the inquiry »Reset Passwords?« with »Yes«.

Changing of Parameters - Example

•Move to the parameter to be change by using the soft keys.

•Press the »Wrench« soft key.

•Enter the password for parameter setting.

•Edit/change the parameter.

Now the User can:

•Save the change made and have it adopted by the system; or

•Change additional parameters and save all the altered parameters and have them adopted by the system.

To Save Parameter Changes Immediately

•Press the »OK« key to save the changed parameters directly and to have them adopted by the device. Confirm the parameter changes by pressing the »Yes« soft key or dismiss by pressing »No« soft key.

To Change Additional Parameters and Save Afterwards

•Move to other parameters and change them.

NOTICE

A star symbol in front of the changed parameters indicates that the modifications have only temporarily been saved. They are not yet stored and adopted by the device.

In order to make things easier to follow, especially where complex parameter changes are involved, on every superior/higher-ranking menu level the intended change of the parameter is indicated by the star symbol (star trace). This makes it possible to control or follow from the main menu level at any time where parameter changes have been made and have not been saved.

In addition to the star trace to the temporarily saved parameter changes, a general parameter changing symbol is faded-in at the left corner of the display, and it is possible from each point of the menu tree to see that there are parameter changes still not adopted by the device.

Press the »OK« key to initiate the final storage of all parameter changes. Confirm the parameter changes by pressing the »Yes« soft key or dismiss by pressing the »No« soft key.

NOTICE

Plausibility Check

In order to prevent obvious wrong settings, the device constantly monitors all temporarily saved parameter changes. If the device detects a conflict, it is indicated by a question mark in front of the respective parameter.

In order to make things easier to follow, especially where complex parameter changes are involved, a question mark appears above the temporarily saved parameters (on every superior/higher- ranking menu level). This makes it possible to control or follow, from the main menu level, where conflicts are intended to be saved. This can be done at any time.

In addition to the question mark trace to the temporarily saved conflict parameter changes, a general conflict symbol/question mark is faded-in at the left corner of the display, and so it is possible to see from each point of the menu tree that conflicts have been detected by the device.

A star/parameter change indication is always overwritten by the question mark/conflict symbol.

If a device detects a conflict, it rejects saving and adopting of the parameters.

Example: If the residual voltage has been configured as »calculated« (*»EVTcon = calculated«*), then the device recognizes a conflict in case voltage measuring is configured as »Phase to Phase« (*»VTcon = Phase to Phase«*). The calculation of the residual voltage is physically not possible by means of phase-to-phase voltages.

Changing of Parameters When Using the PowerPort-E - Example

Example: Changing of a protective parameter (to alter the characteristic for the overcurrent protection function I[1] in parameter set 1).

•If *PowerPort-E* is not in operation, please start the application.

•If the device data have not been loaded, select »Data To Be Received From The Device« in the »Device« menu.

•Double-click the »Protection Para Icon« in the navigation tree.

•Double-click the »Protection Para Set Icon« in the navigation tree.

•Double-click the »Set 1 Icon« in the navigation tree.

•Double-click the »protection stage I[1]« in the navigation tree.

•In the working window, a tabulated overview appears showing the parameters assigned to this protective function.

•In this table double-click the value/parameter to be changed (in this example: *»Char«*).

•Another window (pop-up) is opened where the User can select the required characteristic.

•Close this window by clicking the »OK« key.

NOTICE

A star symbol in front of the changed parameters indicates that the alterations have only temporarily been saved. They are not yet stored and adopted by the software/device.

In order to make things easier to follow, especially where complex parameter changes are involved, on every superior/higher menu level, the intended change of the parameter is indicated by the star symbol (star trace). This makes it possible to control or follow, from the main menu level, where parameter changes have been made and have not been saved. This can be done at any time.

NOTICE

Plausibility Check

In order to prevent obvious wrong settings the application constantly monitors all temporarily saved parameter changes. If the device detects a conflict, it is indicated by a question mark in front of the respective parameter.

In order to make things easier to follow, especially where complex parameter changes are involved, on every superior/higher menu level above of the temporarily saved parameters, a conflict is indicated by a question mark (plausibility trace). This makes it possible to control or follow, from the main menu level, where conflicts exist. This can be done at any time.

So it is possible to see from each point of the menu tree that conflicts have been detected by the application.

A star/parameter change indication is always overwritten by the question mark/conflict symbol.

If the software detects a conflict, it rejects the saving and adopting of the parameters.

Example: If the residual voltage has been configured as *»Calculated«* (*»EVTcon = calculated«*), then the application recognizes a conflict in case voltage measuring is configured as »Phase to Phase« (*»VTcon = Phase to Phase«*). The calculation of the residual voltage is physically not possible by means of phase-to-phase voltages.

•Additional parameters can be changed if required.

•In order to transfer changed parameters into the device, please select »Transfer all parameters into the device« in the »Device« menu.

•Confirm the safety inquiry »Shall The Parameters Be Overwritten?«.

•Enter the password for setting parameters in the pop-up window.

•Confirm the inquiry »Shall The Data Be Saved Locally?« with »Yes« (recommended). Select a suitable storing location on your hard disk.

•Confirm the selected storage location by clicking »Save«

•The changed parameter data is now saved in the data file chosen. Thereafter, the changed data is transferred to the device and adopted.

NOTICE

Once the User has entered the parameter setting password, PowerPort-E will not ask the User again for the password for at least 10 minutes. This time interval will start again each time parameters are transmitted into the device. If for more than 10 minutes no parameters are transmitted into the device, PowerPort-E will again ask for the password when the User tries to transmit parameters into the device.

Protection Parameters

WARNING

Please note that by deactivating, for instance protective functions, the User also changes the functionality of the device.

The manufacturer does not accept liability for any personal or material damage as a result of wrong planning.

Contact your Eaton Customer Service representative for more information.

The protection parameters include the following protection parameter trees.

•Global Protection Parameters *»Global Prot Para«*: Here the User can find all protection parameters that are universally valid. That means that they are valid independent of the protection parameter sets.

•Setting Group Parameters *»Set1..4«*: The protection parameters that the User set within a parameter set are only valid,if the parameter set selected is switched to active.

Setting Groups

Setting Group Switch

Within the »Protection Para/P-Set Switch« menu, the User has the following possibilities:

•To manually set one of the four setting groups active;

•To assign a signal to each setting group that sets this group to active; and

•Scada switches the setting groups.

Setting Group Switch			
	Manual Selection	*Via Input Function (e.g.: Digital Input)*	*Via Scada*
Switching Options	Switch over, if another setting group is chosen manually within the »Protection Para/P-Set Switch« menu.	Switch over not until the request is clear. That means, if there is more or less than one request signal active, no switch over will be executed.	Switch over if there is a clear Scada request. Otherwise no switch over will be executed.

NOTICE

The description of the parameters can be found within the “System Parameters” section.

Setting Group Switch Via PowerPort-E

•If *PowerPort-E* is not running, please start the application.

•If the device data have not been loaded, click »Receive Data From The Device« in the »Device« menu.

•Double click the »Protection Para« icon in the navigation tree.

•Double click the »P-Set Switch« within the protection parameters.

•To configure the Setting Group Switch respectively, manually choose an active set.

NOTICE **The description of the parameters can be found within the “System Parameters” section.**

Copying Setting Groups (Parameter Sets) Via PowerPort-E

NOTICE **Setting groups can only be copied if there are no conflicts (no red question marks).**

It is not necessary to set up two setting groups that only differ in few parameters.

With the help of „PowerPort-E, the User can simply copy an existing setting group to another (not yet configured) one. The User only needs to change those parameters where the two setting groups are different.

To efficiently establish a second parameter set where only few parameters are different, proceed as follows.

•If *PowerPort-E* is not running, please start the application.

•Open a (off-line) parameter file of a device or load data of a connected device.

•By way of precaution, save the (relevant) device parameters by selecting [File\Save as].

•Select »Copy Parameter Sets« out of the “Edit” menu.

•Then define both source and destination of the parameter sets to be copied (source = copy from; destination: copy to).

•Click on »OK« to start copy procedure.

•The copied parameter set is now cached (not yet saved!).

•Then, modify the copied parameter set(s), if applicable.

•Assign a new file name to the revised device parameter file and save it on your hard disk (backup copy).

•To transfer the modified parameters back to the device, click on menu item »Device« and select »Transfer All Parameters into the Device«.

Comparing Setting Groups Via PowerPort-E

•If *PowerPort-E* is not running, please start the application.

•Click on menu item »Edit« and select »Compare Parameter Sets«.

•Select the two parameter sets from the (two) drop down menus that are to be compared with each other.

•Press the »Compare« button.

•The values that are different from the set parameters will be listed in tabular form.

Comparing Parameter Files Via PowerPort-E

With the help of PowerPort-E, the User can simply compare/differentiate the currently open parameter/device file against a file on the hard disk. The precondition is that the versions and type of devices match. To compare the parameter files, please proceed as follows.

•Click on »Compare with a Parameter File« within the »Device« menu.

•Click on the Folder icon in order to select a file on your hard disk.

•The differences will be shown in tabular form.

Converting Parameter Files Via PowerPort-E

Parameter files of the same type can be up- or downgraded (converted). As many parameters as possible will be taken over.

•Parameters that are newly added will be set to default.

•Parameters that are not included in the target file version will be deleted.

In order to convert a parameter file please proceed as follows.

•If *PowerPort-E* is not in operation, please start the application.

•Open a parameter file or load the parameters from a device that should be converted.

•Make a backup of this file in a fail-safe place.

•Choose »Save as« from the »File« menu.

•Enter a new file name (in order to prevent overwriting the original file).

•Choose the new file type from drop down menu »File Type«.

•Confirm the security check by clicking on »Yes« only if the User is sure that the file conversion should be executed.

•In tabular form the modifications will be shown as follows.

Added parameter:	
Deleted parameter:	

System Parameters

87

Within the system parameters, the User can set all parameters that are relevant for the primary side and the mains operational method like frequency, primary and secondary values, and the star point treatment.

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Phase Sequence	Phase Sequence direction	ABC, ACB	ABC	[System Para /General Settings]
f	Nominal frequency	50Hz, 60Hz	60Hz	[System Para /General Settings]
SN	Maximum Apparent Power of the Transformer. This has to be entered in kVA.	1 - 800000kVA	5250kVA	[System Para /Transformer]
TrV W1	Transformer rated voltage at side W1. Primary Side Nominal Voltage	60 - 500000V	13200V	[System Para /Transformer]
TrV W2	Transformer rated voltage at side W2. Secondary Side Nominal Voltage	60 - 500000V	4160V	[System Para /Transformer]
W1 Connection/Grounding	Note: The zero current will be removed in order to prevent faulty tripping of the differential protection. If a star point is connected to ground according to the winding connection, the zero current (symmetrical components) will be removed.	Y, D, Z, YN, ZN	D	[System Para /Transformer]

W2 Connection/Grounding	Note: The zero current will be removed in order to prevent faulty tripping of the differential protection. If a star point is connected to ground according to the winding connection, the zero current (symmetrical components) will be removed.	y, d, z, yn, zn	yn	[System Para /Transformer]
Phase Shift	Angle that the secondary winding lags or leads the primary winding, depending on winding connection and system rotation. The phase shift angle is factor (1,2,3...11) multiplied with 30 degrees.	0 - 11	1	[System Para /Transformer]
Tap changer	Tap changer, the tapchanger refers to the primary side (W1).	-15 - 15%	0%	[System Para /Transformer]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
CT pri	Nominal current of the primary side of the current transformers.	1 - 50000A	W1: 400A W2: 1200A	[System Para /W1]
CT sec	Nominal current of the secondary side of the current transformers.	1A, 5A	5A	[System Para /W1]

CT dir	Protection functions with directional feature can only work properly if the connection of the current transformers is free of wiring errors. If all current transformers are connected to the device with a wrong polarity, the wiring error can be compensated by this parameter. This parameter turns the current vectors by 180 degrees.	0°, 180°	0°	[System Para /W1]
XCT pri	This parameter defines the primary nominal current of the connected ground current transformer. If the ground current is measured via the Residual connection, the primary value of the phase current transformer must be entered here.	1 - 50000A	50A	[System Para /W1]
XCT sec	This parameter defines the secondary nominal current of the connected ground current transformer. If the ground current is done via the Residual connection, the primary value of the phase current transformer must be entered here.	1A, 5A	5A	[System Para /W1]

XCT dir	Ground fault protection with directional feature depends also on the correct wiring of the ground current transformer. A wrong polarity/wiring can be corrected by means of the settings "0°" or "180°". The operator has the possibility of turning the current vector by "180°" (change of sign) without modification of the wiring. This means, that – in terms of figures - the determined current indicator was turned by "180°" by the device.	0°, 180°	0°	[System Para /W1]

Statistics of the System Parameters

Value	*Description*	*Menu Path*
IrA max	Measured Value (Calculated): Restraint Current Phase A Maximum Value	[Operation /Statistics /87]
IrB max	Measured Value (Calculated): Restraint Current Phase B Maximum Value	[Operation /Statistics /87]
IrC max	Measured Value (Calculated): Restraint Current Phase C Maximum Value	[Operation /Statistics /87]
IdA max	Measured Value (Calculated): Differential Current Phase A Maximum Value	[Operation /Statistics /87]
IdB max	Measured Value (Calculated): Differential Current Phase B Maximum Value	[Operation /Statistics /87]
IdC max	Measured Value (Calculated): Differential Current Phase C Maximum Value	[Operation /Statistics /87]
IrG W1 max	Measured Value (Calculated): Ground Restraint Current Winding 1 Maximum Value	[Operation /Statistics /87GD W1]
IdG W1 max	Measured Value (Calculated): Ground Differential Current Winding 1 Maximum Value	[Operation /Statistics /87GD W1]
IrG W2 max	Measured Value (Calculated): Ground Restraint Current Winding 2 Maximum Value	[Operation /Statistics /87GD W2]
IdG W2 max	Measured Value (Calculated): Ground Differential Current Winding 2 Maximum Value	[Operation /Statistics /87GD W2]

Blockings

The device provides a function for temporary blocking of the complete protection functionality or of single protections.

WARNING

Make absolutely sure that no illogical or even life-threatening blockings are allocated.

Make sure not to carelessly deactivate protection functions that have to be available according to the protection concept.

Permanent Blocking

Switching "On" or "Off" the Complete Protection Functionality

In the *»Protection«* module, the complete protection of the device can be switched "On" or "Off". Set the Function parameter to *»Active«* or *»Inactive«* in the *»Prot«* module.

WARNING

Protection is activated only if in the »Prot« module the parameter *Function* is = *»Active«* (i.e.: with *»Function«* = *»Inactive«,* no protection function is operating). If *»Function«* = *»Inactive«, t*hen the device cannot protect any components.

Switching Modules "On" or "Off"

Each of the modules can be switched "On" or "Off" (permanently). This is achieved when the »*Function«* parameter is set to »Active« or »Inactive« in the respective module.

Activating or Deactivating the Tripping Command of a Protection Permanently

In each of the protections, the tripping command to the breaker can be permanently blocked. For this purpose, the *»TripCmd Blo«* parameter has to be set to *»Active«*.

Temporary Blocking

To Block the Complete Protection of the Device Temporarily by a Signal

In the *»Prot«* module, the complete protection of the device can be blocked temporarily by a signal. On the condition that a module-external blocking is permitted (*»ExBlo Fc=active«)*. In addition to this, a related blocking signal from the »Assignment list« must have been assigned. For the time the allocated blocking signal is active, the module is blocked.

WARNING

If the *»Prot«* module is blocked, the complete protection function does not work. As long as the blocking signal is active, the device cannot protect any components.

To Block a Complete Protection Module Temporarily by an Active Assignment

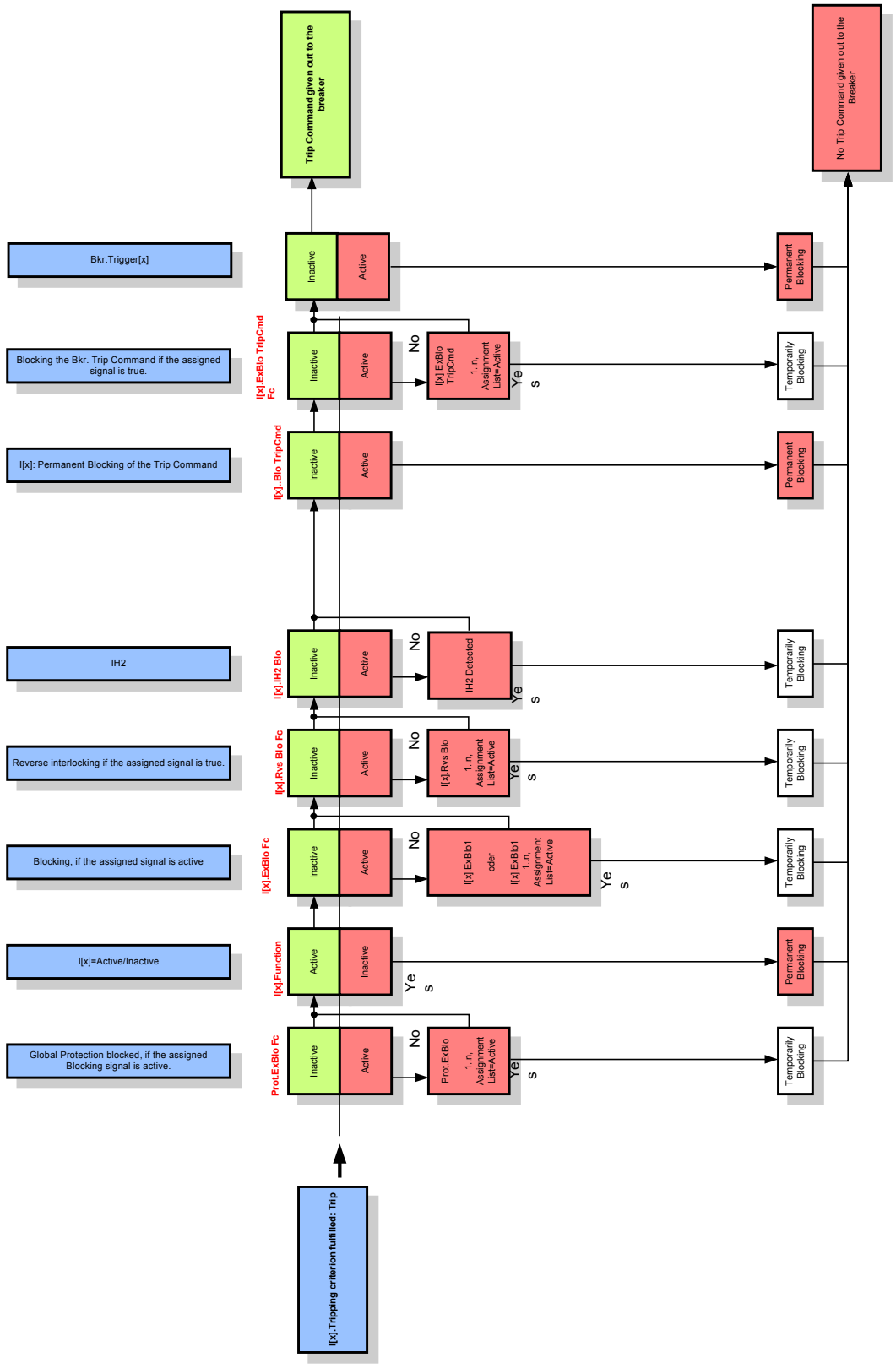
- In order to establish a temporary blockage of a protection module, the parameter *»ExBlo Fc«* of the module has to be set to *»Active«*. This gives the permission: »This module can be blocked«.
- Within the general protection parameters, a signal has to be additionally chosen from the »Assignment list«. The blocking only becomes active when the assigned signal is active.

To Block the Tripping Command of a Protection Element Temporarily by an Active Assignment

The tripping command of any of the protection modules can be blocked from external. In this case, external does not only mean from outside the device, but also from outside the module. Not only real external signals are permitted to be used as blocking signals (for example: the state of a digital input), but you can also choose any other signal from the »Assignment list«.

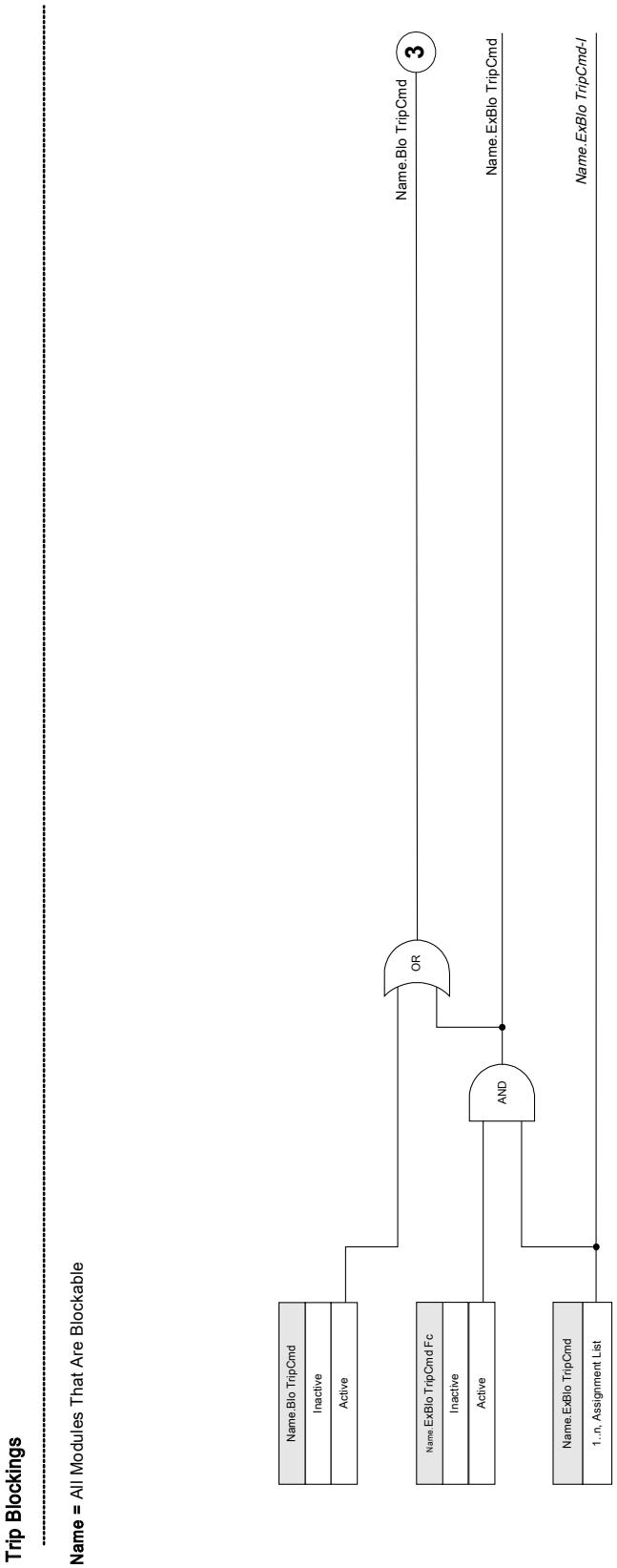
- In order to establish a temporary blockage of a protection element, the parameter *»ExBlo TripCmd Fc«* of the module has to be set to *»Active«*. This gives the permission: »The tripping command of this element can be blocked«.

- Within the general protection parameters, an additional signal has to be chosen and assigned to the *»ExBlo«* parameter from the »Assignment list«. If the selected signal is activated, the temporary blockage becomes effective.

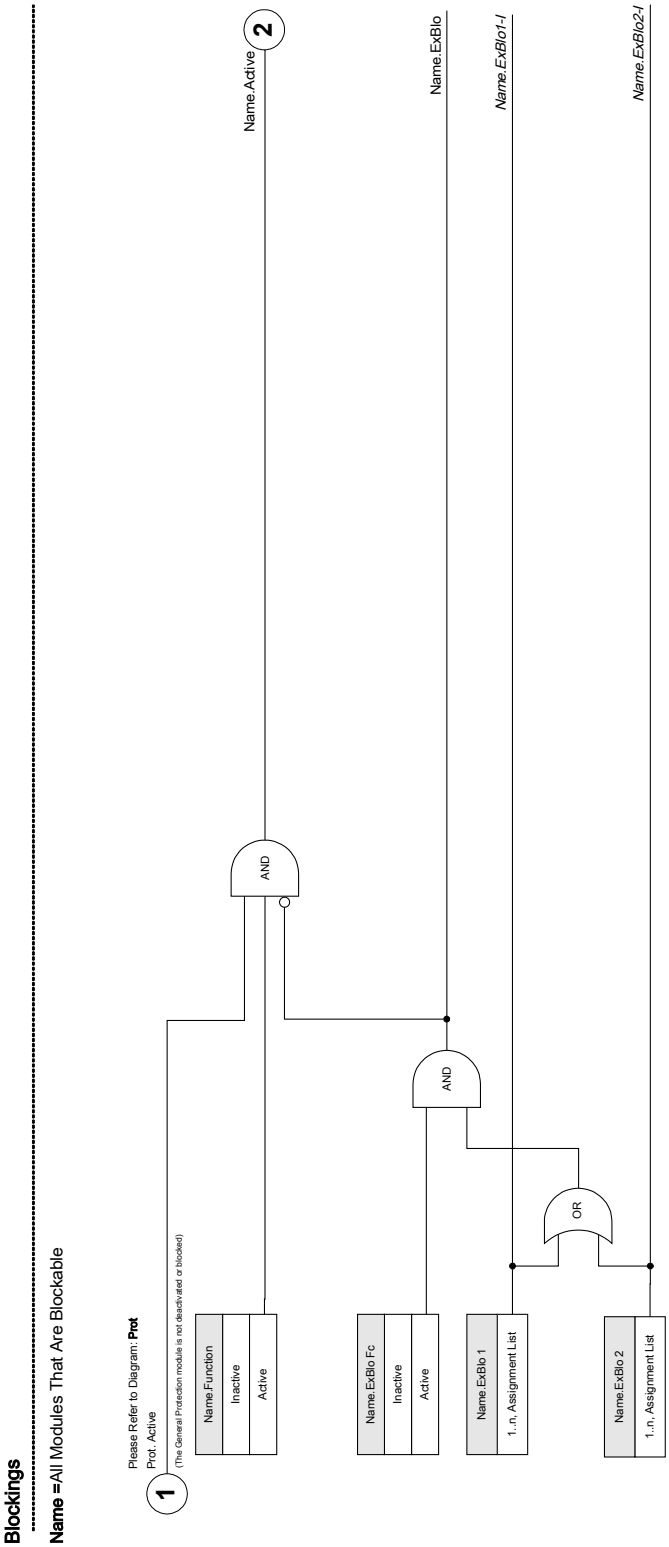


Tripping criterion fulfilled for I (overcurrent protection module: e.g. 50P[x]). How could the trip command be blocked?

To Activate or Deactivate the Tripping Command of a Protection Module

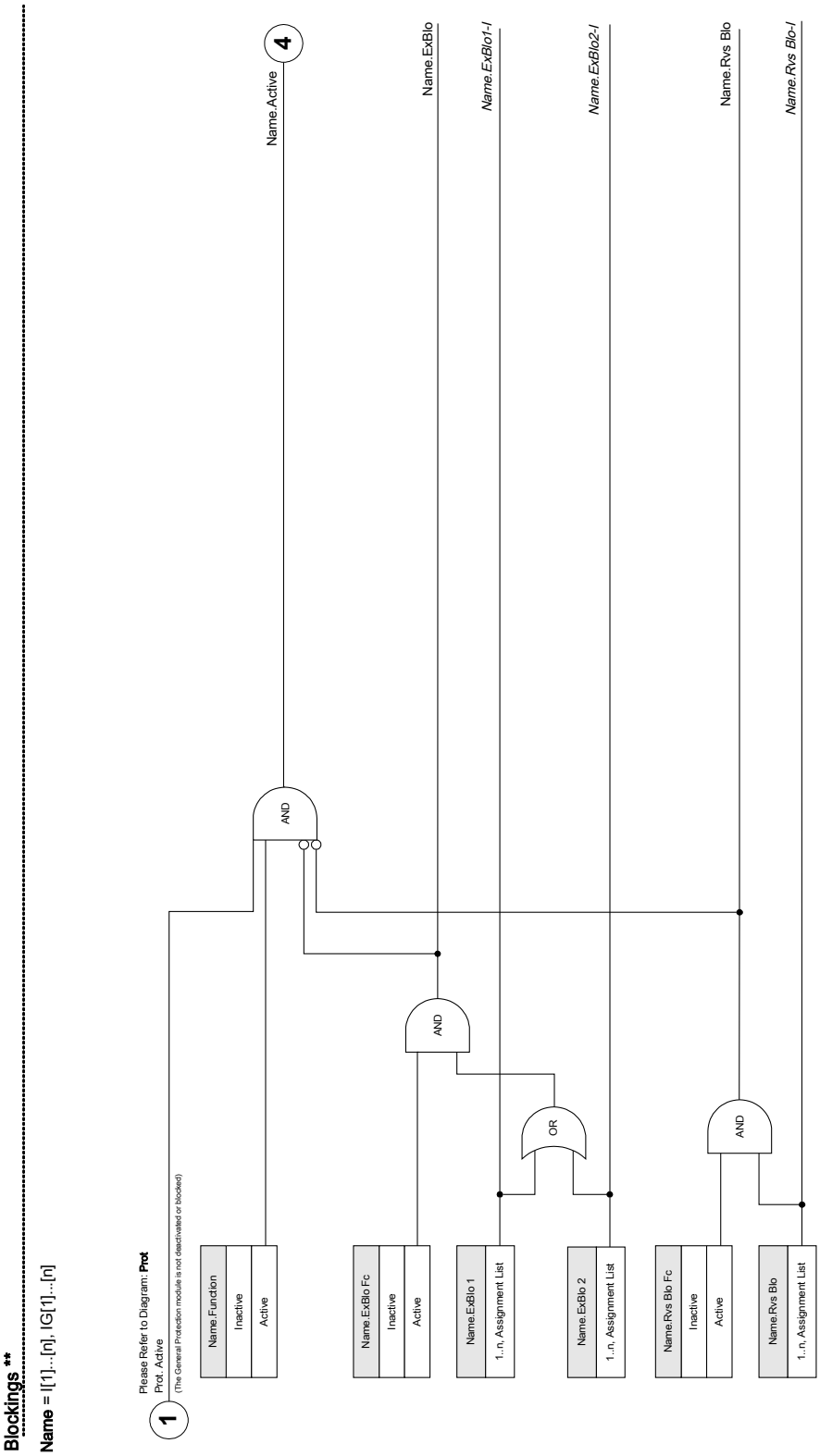


Activate, Deactivate Respectively to Block Temporary Protection Functions



Current protective functions cannot only be blocked permanently (»F*unction = Inactive*«) or temporarily by any blocking signal from the »Assignment list«, but also by *»Reverse Interlocking«*.

All other protection functions can be activated, deactivated, or blocked in the same manner.



Module: Protection (Prot)

Prot

The *»Protection«* module serves as the outer frame for all other protection modules (i.e.: they are all enclosed by the *»Protection«* Module).

WARNING **In the case where the *»Protection«* module is blocked, the complete protective function of the device is disabled.**

Module Prot Blocked - Protection Inactive:

If the master *»Protection«* module is allowed to be temporarily blocked and the allocated blocking signals are active, then all protection functions will be disabled. In such a case, the protective function is »Inactive«.

Protection Active:

If the master *»Protection«* **module** was activated and a blockade for this module was not activated respectively, the assigned blocking signals are inactive at that moment, then the *»Protection«* is »Active«.

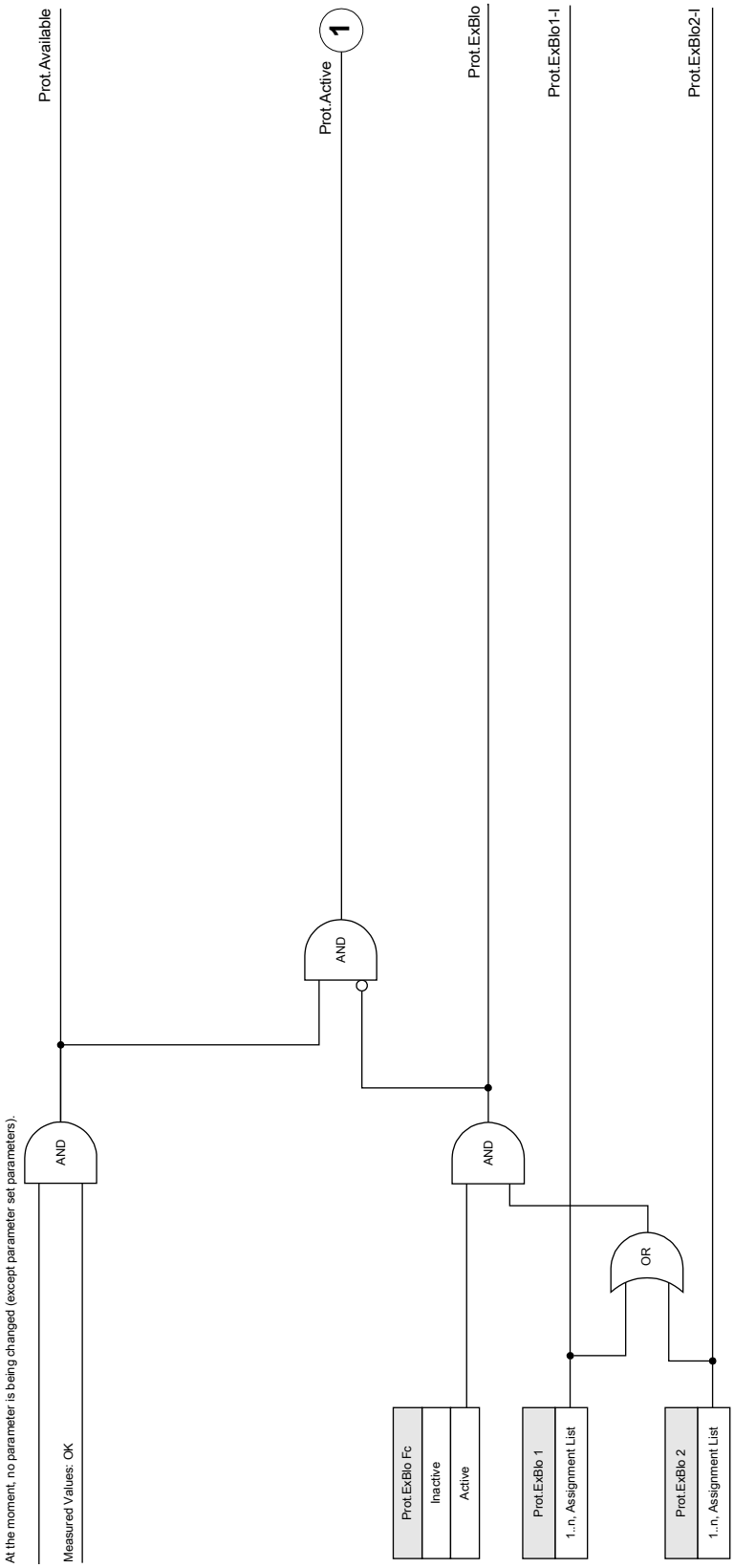
How to Block the Entire Protection

In order to allow (the principle use) of blocking the entire protection call up the menu [Protection/Para/Global Prot Para/Prot]:

- Set the parameter »*ExBlo Fc = active*«;
- Choose an assignment for »*ExBlo1*«; and
- Optionally choose an assignment for »*ExBlo2*«.

If the signal becomes true, then the entire protection will be blocked as long as one of these signals are true.

Prot - Active


Prot.Available
Prot.Active
1
Prot.ExBlo
Prot.ExBlo1-I
Prot.ExBlo2-I
AND
AND
AND
OR
At the moment, no parameter is being changed (except parameter set parameters).
Measured Values: OK
Prot.ExBlo Fc
Inactive
Active
Prot.ExBlo 1
1..n, Assignment List
Prot.ExBlo 2
1..n, Assignment List

Each protection element generates its own pickup and trip signals, which are automatically passed onto the *»Prot«* module where the phase based and general (collective) pickup and trip signals are generated. The *»Prot«* module serves as a top level and a common place to group all pickups and trips from each individual protection element.

For instance, »PROT.PICKUP PHASE A« is the phase A pickup signal OR-ed from all protection elements; »PROT.TRIP PHASE A« is the phase A trip signal OR-ed from all protection elements; »PROT.PICKUP« is the collective pickup signal OR-ed from all protection elements; Prot.Trip is the collective Trip signal OR-ed from all protection elements, and etc. The Tripping commands of the protection elements have to be fed to the *»Bkr Manager«* module for further trip request processing.

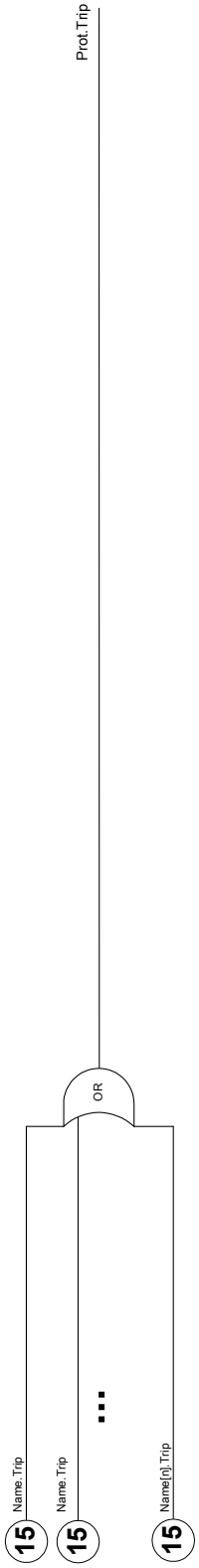
WARNING **The tripping commands are executed by the *»Bkr Manager«* module.**
Tripping commands have to be assigned to a breaker. The Breaker Manager will issue the trip command to the breaker.

If a protection element is activated and respectively decides to trip, two pickup signals will be created.

1. The module or the protection element issues an pickup/alarm (e.g.: »50P[1].PICKUP or »50P[1].TRIP«).
2. The master *»Prot«* module collects/summarizes the signals and issues an pickup/alarm or a trip signal »PROT.PICKUP« »PROT.TRIP«.

Prot.Trip

Name = Each trip of an active, trip authorized protection module will lead to a general trip.

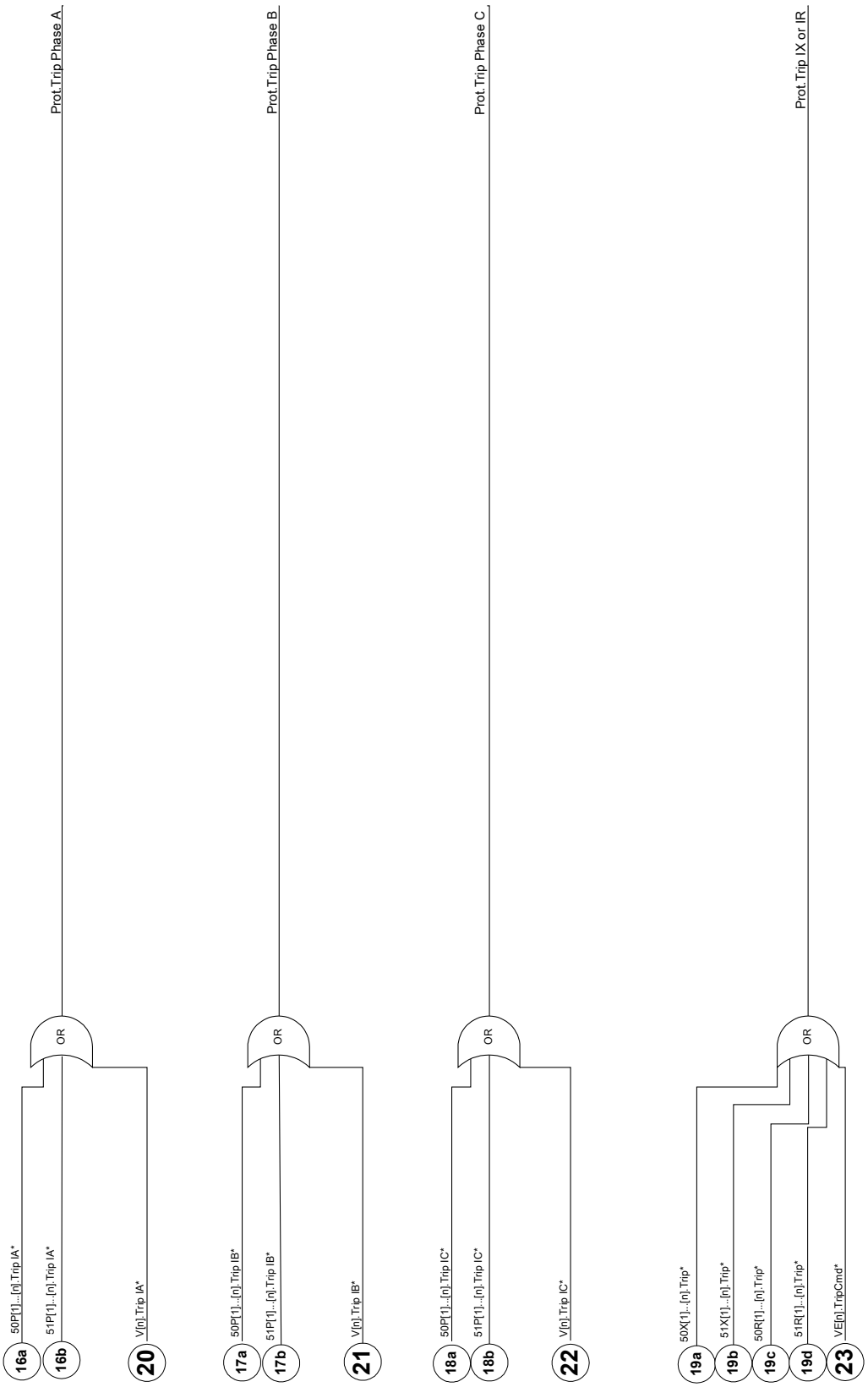


Prot.Pickup

Name = Each pickup of a module (except from supervision modules but including BF) will lead to a general pickup (collective pickup).

Prot.Trip

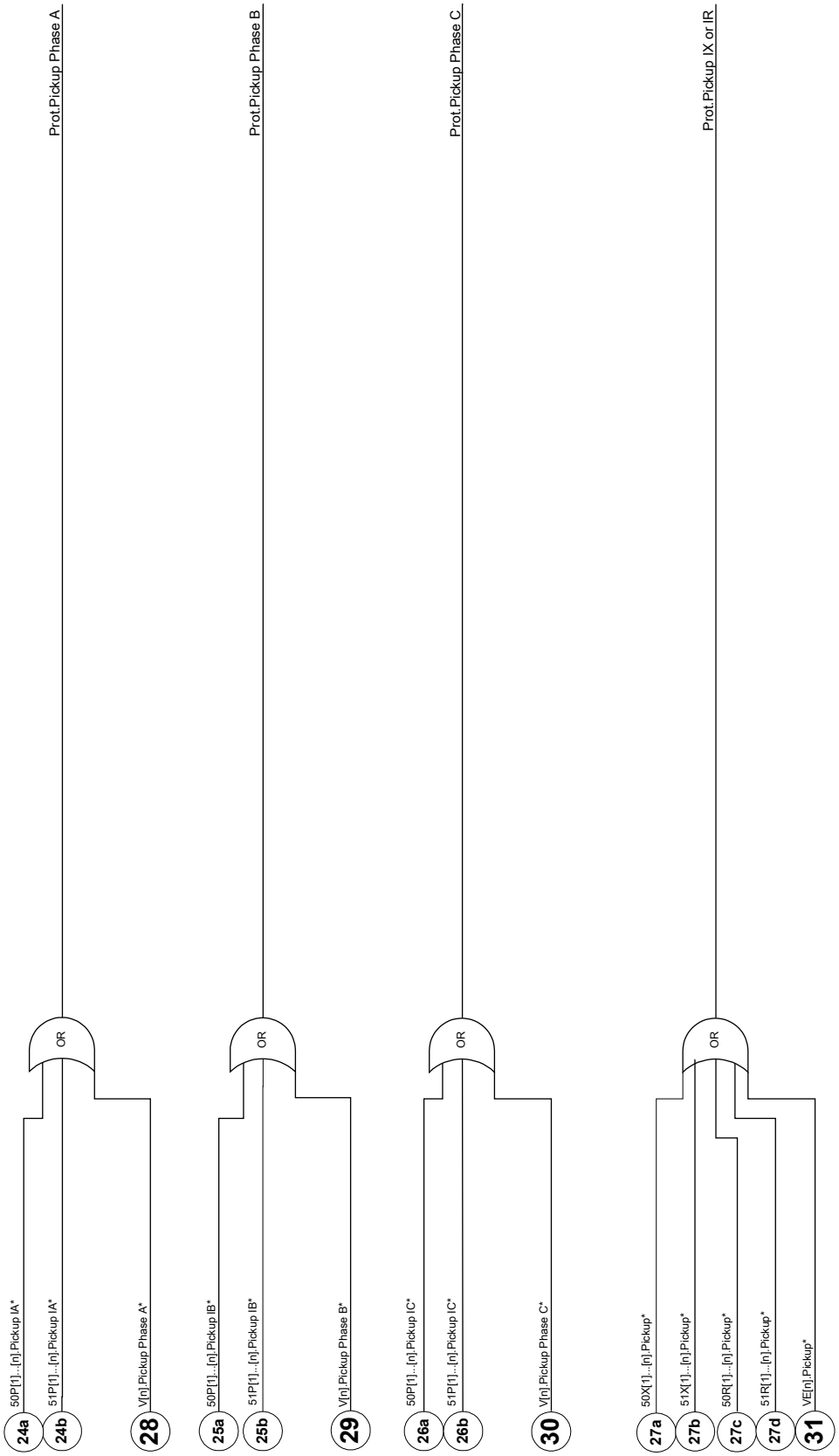
Each phase selective trip of a trip authorized module (I, IG, V, VE depending on the device type) will lead to a phase selective general trip.



*=Depending on the type of device

Prot.Pickup

Each phase selective pickup of a module (I, IG, V, VE depending on the device type) will lead to a phase selective general pickup (collective pickup).



*=Depending on the type of device

Direct Commands of the Protection Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Res Fault a Mains No	Resetting of fault number and number of grid faults.	Inactive, Active	Inactive	[Operation /Reset]

Global Protection Parameters of the Protection Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
ExBlo Fc	Activate (allow) the external blocking of the global protection functionality of the device.	Inactive, Active	Inactive	[Protection Para /Global Prot Para /Prot]
ExBlo1	If external blocking of this module is activated (allowed), the global protection functionality of the device will be blocked if the state of the assigned signal becomes true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Prot]
ExBlo2	If external blocking of this module is activated (allowed), the global protection functionality of the device will be blocked if the state of the assigned signal becomes true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Prot]

Protection Module Input States

Name	*Description*	*Assignment Via*
ExBlo1-I	Module Input State: External Blocking1	[Protection Para /Global Prot Para /Prot]
ExBlo2-I	Module Input State: External Blocking2	[Protection Para /Global Prot Para /Prot]

Protection Module Signals (Output States)

Name	*Description*
Available	Signal: Protection is available.
Active	Signal: Active
ExBlo	Signal: External Blocking
Pickup Phase A	Signal: General Pickup Phase A
Pickup Phase B	Signal: General Pickup Phase B
Pickup Phase C	Signal: General Pickup Phase C
Pickup IX or IR	Signal: General Pickup - Ground Fault
Pickup	Signal: General Pickup
Trip Phase A	Signal: General Trip Phase A
Trip Phase B	Signal: General Trip Phase B
Trip Phase C	Signal: General Trip Phase C
Trip IX or IR	Signal: General Trip Ground Fault
Trip	Signal: General Trip
Res Fault a Mains No	Signal: Resetting of fault number and number of grid faults.

Protection Module Values

Value	*Description*	*Menu Path*
FaultNo	Disturbance No.	[Operation /Count and RevData /Prot]
No of grid faults	Number of grid faults: A grid fault, e.g. a short circuit, might cause several faults with trip and autoreclosing, each fault being identified by an increased fault number. In this case, the grid fault number remains the same.	[Operation /Count and RevData /Prot]

Breaker (Manager)

Bkr[1] ,Bkr[2]

Principle – General Use

By means of this module [Protection Para/Global Prot Para/Bkr Manager], the breaker is managed. That means:

•Assign the signal that represents the wired 52a contact (minimum requirement);

•Assign the signal that represents the wired 52b contact (recommendation);

•Assign the signal that represents »*Manual Close*« command
(This digital input can be used by some protective elements (if they are available within the device) like Switch Onto Fault (SOTF), e.g. as a trigger signal.);

•Assign the signal that represents »*Manual Open*« command;
(This digital input can be used by some protective elements (if they are available within the device) like Cold Load Pickup (CLPU), e.g. as a trigger signal.)

•Assign the signal that represents »*Bkr ready*«;
(This digital input can be used by some protective elements (if they are available within the device) like Auto Reclosure (AR), e.g. as a trigger signal.)

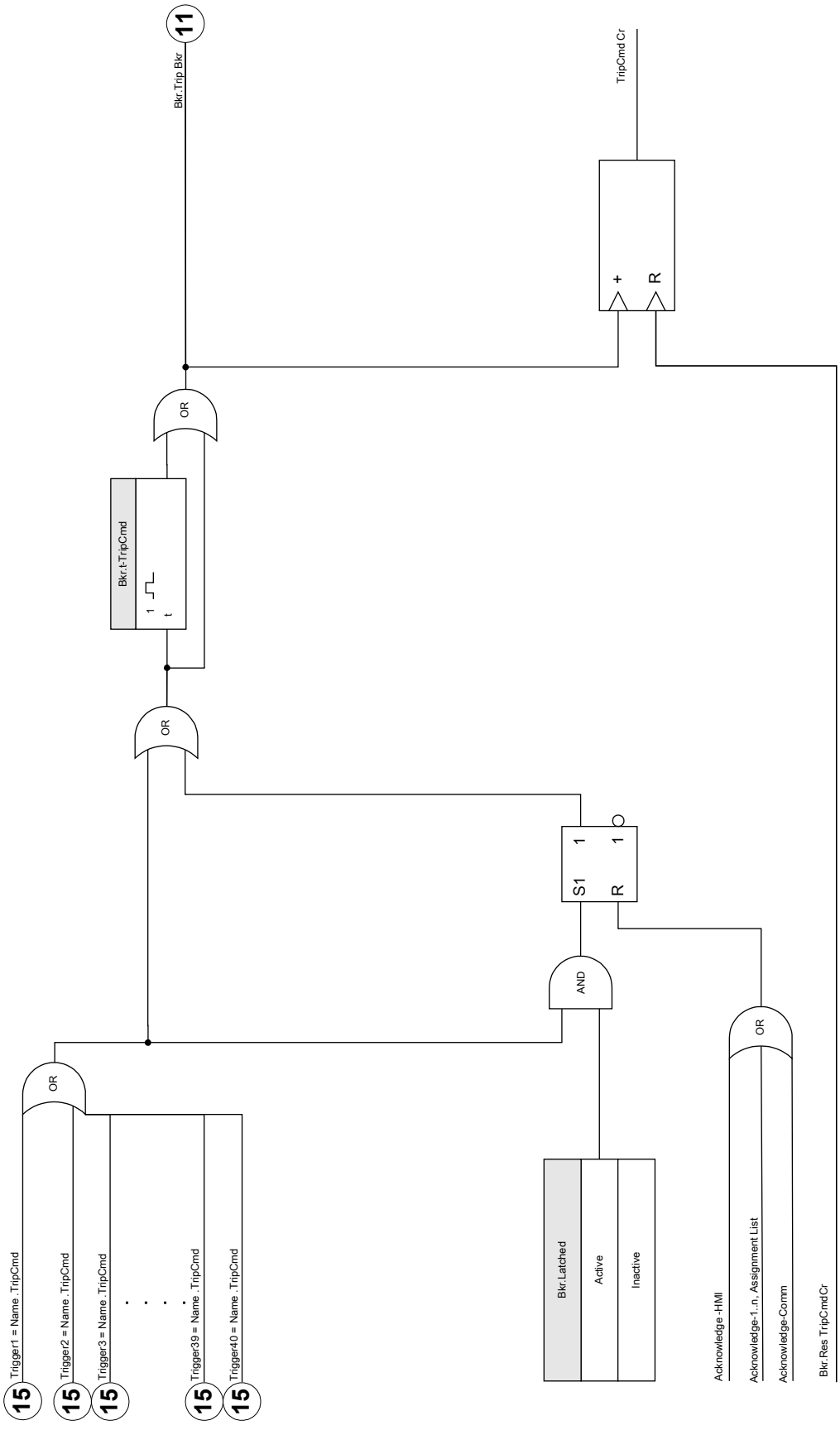
•Determine whether the Open command is latched;

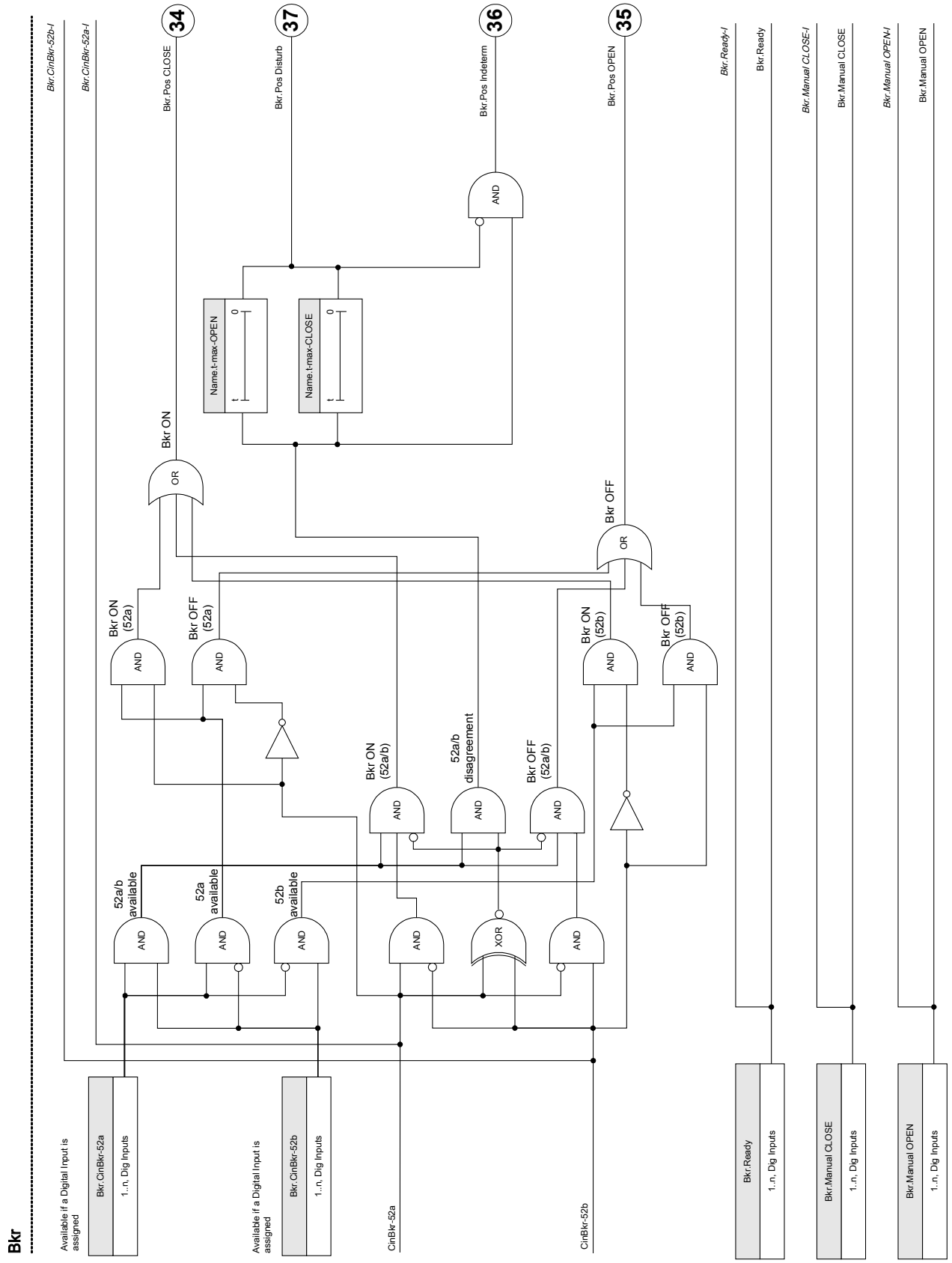
•Determine the minimum hold time of the tripping command; and

•Determine which trip decisions of protection modules should be issued to the breaker. The command for tripping can come from each of the protection modules, but the actual tripping command to the breaker is only given by the *»Bkr«* module. Therefore the User can assign up to 40 trip decisions. Those will be issued to the breaker by an “OR” logic.

Bkr.Trip Bkr

Name =Each trip of an active, trip authorized protection module can be assigned to an breaker.




Bkr
Bkr.CinBkr-52b-I
Bkr.CinBkr-52a-I
Bkr.Pos CLOSE
Bkr.Pos Disturb
Bkr.Pos Indeterm
Bkr.Pos OPEN
34
37
36
35
Name.t-max-OPEN
Name.t-max-CLOSE
Bkr ON
Bkr OFF
Bkr ON (52a)
Bkr OFF (52a)
Bkr ON (52b)
Bkr OFF (52b)
Bkr ON (52a/b)
52a/b disagreement
Bkr OFF (52a/b)
52a/b available
52a available
52b available
AND
OR
XOR
Available if a Digital Input is assigned
Bkr.CinBkr-52a
1..n. Dig Inputs
Available if a Digital Input is assigned
Bkr.CinBkr-52b
1..n. Dig Inputs
CinBkr-52a
CinBkr-52b
Bkr.Ready-I
Bkr.Ready
Bkr.Ready
1..n. Dig Inputs
Bkr.Manual CLOSE-I
Bkr.Manual CLOSE
Bkr.Manual CLOSE
1..n. Dig Inputs
Bkr.Manual OPEN-I
Bkr.Manual OPEN
Bkr.Manual OPEN
1..n. Dig Inputs

Direct Commands of the Breaker (Manager)

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Ack TripCmd	Acknowledge Trip Command	Inactive, Active	Inactive	[Operation /Reset]

Global Protection Parameters of the Breaker (Manager)

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
t-TripCmd	Minimum hold time of the OPEN-command (Breaker, load break switch)	0 - 300.00s	0.1s	[Protection Para /Global Prot Para /Bkr Manager /Bkr[1]]
Latched	Defines whether the Relay Output will be Latched when it picks up.	Inactive, Active	Inactive	[Protection Para /Global Prot Para /Bkr Manager /Bkr[1]]
Ack TripCmd	Acknowledge Trip Command	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Bkr Manager /Bkr[1]]
t-max-OPEN	Within this time the OPEN command has to be carried out by the breaker. Within this time the position indicators (check back signals) have to change from CLOSE to OPEN.	0.00 - 10.00s	0.10s	[Protection Para /Global Prot Para /Bkr Manager /Bkr[1]]
t-max-CLOSE	Within this time the CLOSE command has to be carried out by the breaker. Within this time the position indicators (check back signals) have to change from OPEN to CLOSE.	0.00 - 10.00s	0.10s	[Protection Para /Global Prot Para /Bkr Manager /Bkr[1]]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
CinBkr-52a	The breaker is in CLOSE-position if the state of the assigned signal is true (52a).	-.-, DI Slot X1.DI 1, DI Slot X1.DI 2, DI Slot X1.DI 3, DI Slot X1.DI 4, DI Slot X1.DI 5, DI Slot X1.DI 6, DI Slot X1.DI 7, DI Slot X1.DI 8	Bkr[1]: DI Slot X1.DI 5 Bkr[2]: DI Slot X1.DI 6	[Protection Para /Global Prot Para /Bkr Manager /Bkr[1]]
CinBkr-52b	The breaker is in OPEN-position if the state of the assigned signal is true (52b).	-.-, DI Slot X1.DI 1, DI Slot X1.DI 2, DI Slot X1.DI 3, DI Slot X1.DI 4, DI Slot X1.DI 5, DI Slot X1.DI 6, DI Slot X1.DI 7, DI Slot X1.DI 8	-.-	[Protection Para /Global Prot Para /Bkr Manager /Bkr[1]]
Manual CLOSE	The breaker was switched on manually if the state of the assigned signal is true. This digital input can be used by some protective elements (if they are available within the device) like Switch Onto Fault (SOTF), e.g. as a trigger signal.	-.-, DI Slot X1.DI 1, DI Slot X1.DI 2, DI Slot X1.DI 3, DI Slot X1.DI 4, DI Slot X1.DI 5, DI Slot X1.DI 6, DI Slot X1.DI 7, DI Slot X1.DI 8	-.-	[Protection Para /Global Prot Para /Bkr Manager /Bkr[1]]
Manual OPEN	The breaker was switched off (OPEN) manually if the state of the assigned signal is true. This digital input can be used by some protective elements (if they are available within the device) like Cold Load Pickup (CLPU), e.g. as a trigger signal.	-.-, DI Slot X1.DI 1, DI Slot X1.DI 2, DI Slot X1.DI 3, DI Slot X1.DI 4, DI Slot X1.DI 5, DI Slot X1.DI 6, DI Slot X1.DI 7, DI Slot X1.DI 8	-.-	[Protection Para /Global Prot Para /Bkr Manager /Bkr[1]]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Ready	Breaker is ready for operation if the state of the assigned signal is true. This digital input can be used by some protective elements (if they are available within the device) like Auto Reclosure (AR), e.g. as a trigger signal.	-.-, DI Slot X1.DI 1, DI Slot X1.DI 2, DI Slot X1.DI 3, DI Slot X1.DI 4, DI Slot X1.DI 5, DI Slot X1.DI 6, DI Slot X1.DI 7, DI Slot X1.DI 8	-.-	[Protection Para /Global Prot Para /Bkr Manager /Bkr[1]]
Trigger1	Open Command to the Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	Bkr[1]: 50P[1].TripCmd Bkr[2]: 50P[3].TripCmd	[Protection Para /Global Prot Para /Bkr Manager /Bkr[1]]
Trigger2	Open Command to the Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	Bkr[1]: 50P[2].TripCmd Bkr[2]: 50P[4].TripCmd	[Protection Para /Global Prot Para /Bkr Manager /Bkr[1]]
Trigger3	Open Command to the Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	Bkr[1]: 51P[1].TripCmd Bkr[2]: 51P[3].TripCmd	[Protection Para /Global Prot Para /Bkr Manager /Bkr[1]]
Trigger4	Open Command to the Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	Bkr[1]: 51P[2].TripCmd Bkr[2]: 51P[4].TripCmd	[Protection Para /Global Prot Para /Bkr Manager /Bkr[1]]
Trigger5	Open Command to the Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	Bkr[1]: 50X[1].TripCmd Bkr[2]: 50X[2].TripCmd	[Protection Para /Global Prot Para /Bkr Manager /Bkr[1]]
Trigger6	Open Command to the Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	Bkr[1]: 51X[1].TripCmd Bkr[2]: 51X[2].TripCmd	[Protection Para /Global Prot Para /Bkr Manager /Bkr[1]]
Trigger7	Open Command to the Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	Bkr[1]: 50R[1].TripCmd Bkr[2]: 50R[2].TripCmd	[Protection Para /Global Prot Para /Bkr Manager /Bkr[1]]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Trigger8	Open Command to the Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	Bkr[1]: 51R[1].TripCmd Bkr[2]: 51R[2].TripCmd	[Protection Para /Global Prot Para /Bkr Manager /Bkr[1]]
Trigger9	Open Command to the Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	Bkr[1]: 51Q[1].TripCmd Bkr[2]: -.-	[Protection Para /Global Prot Para /Bkr Manager /Bkr[1]]
Trigger10	Open Command to the Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Protection Para /Global Prot Para /Bkr Manager /Bkr[1]]
Trigger11	Open Command to the Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Protection Para /Global Prot Para /Bkr Manager /Bkr[1]]
Trigger12	Open Command to the Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Protection Para /Global Prot Para /Bkr Manager /Bkr[1]]
Trigger13	Open Command to the Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Protection Para /Global Prot Para /Bkr Manager /Bkr[1]]
Trigger14	Open Command to the Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Protection Para /Global Prot Para /Bkr Manager /Bkr[1]]
Trigger15	Open Command to the Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Protection Para /Global Prot Para /Bkr Manager /Bkr[1]]
Trigger16	Open Command to the Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Protection Para /Global Prot Para /Bkr Manager /Bkr[1]]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Trigger17	Open Command to the Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Protection Para /Global Prot Para /Bkr Manager /Bkr[1]]
Trigger18	Open Command to the Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Protection Para /Global Prot Para /Bkr Manager /Bkr[1]]
Trigger19	Open Command to the Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Protection Para /Global Prot Para /Bkr Manager /Bkr[1]]
Trigger20	Open Command to the Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Protection Para /Global Prot Para /Bkr Manager /Bkr[1]]
Trigger21	Open Command to the Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Protection Para /Global Prot Para /Bkr Manager /Bkr[1]]
Trigger22	Open Command to the Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Protection Para /Global Prot Para /Bkr Manager /Bkr[1]]
Trigger23	Open Command to the Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Protection Para /Global Prot Para /Bkr Manager /Bkr[1]]
Trigger24	Open Command to the Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Protection Para /Global Prot Para /Bkr Manager /Bkr[1]]
Trigger25	Open Command to the Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Protection Para /Global Prot Para /Bkr Manager /Bkr[1]]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Trigger26	Open Command to the Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Protection Para /Global Prot Para /Bkr Manager /Bkr[1]]
Trigger27	Open Command to the Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Protection Para /Global Prot Para /Bkr Manager /Bkr[1]]
Trigger28	Open Command to the Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Protection Para /Global Prot Para /Bkr Manager /Bkr[1]]
Trigger29	Open Command to the Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Protection Para /Global Prot Para /Bkr Manager /Bkr[1]]
Trigger30	Open Command to the Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Protection Para /Global Prot Para /Bkr Manager /Bkr[1]]
Trigger31	Open Command to the Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Protection Para /Global Prot Para /Bkr Manager /Bkr[1]]
Trigger32	Open Command to the Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Protection Para /Global Prot Para /Bkr Manager /Bkr[1]]
Trigger33	Open Command to the Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Protection Para /Global Prot Para /Bkr Manager /Bkr[1]]
Trigger34	Open Command to the Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Protection Para /Global Prot Para /Bkr Manager /Bkr[1]]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Trigger35	Open Command to the Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Protection Para /Global Prot Para /Bkr Manager /Bkr[1]]
Trigger36	Open Command to the Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Protection Para /Global Prot Para /Bkr Manager /Bkr[1]]
Trigger37	Open Command to the Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Protection Para /Global Prot Para /Bkr Manager /Bkr[1]]
Trigger38	Open Command to the Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Protection Para /Global Prot Para /Bkr Manager /Bkr[1]]
Trigger39	Open Command to the Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Protection Para /Global Prot Para /Bkr Manager /Bkr[1]]
Trigger40	Open Command to the Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Protection Para /Global Prot Para /Bkr Manager /Bkr[1]]

Breaker (Manager) Input States

Name	*Description*	*Assignment Via*
Acknow Sig-I	Module Input State: Acknowledgment Signal (only for automatic acknowledgment). Module input signal	[Protection Para /Global Prot Para /Bkr Manager /Bkr[1]]
CinBkr-52a-I	Position indicator/check-back signal of the Bkr (52a)	[Protection Para /Global Prot Para /Bkr Manager /Bkr[1]]
CinBkr-52b-I	Module Input State: Position indicator/check-back signal of the Bkr. (52b)	[Protection Para /Global Prot Para /Bkr Manager /Bkr[1]]
Manual CLOSE-I	Module Input State: Breaker was switched on manually.	[Protection Para /Global Prot Para /Bkr Manager /Bkr[1]]
Manual OPEN-I	Module Input State: Breaker was switched off (OPEN) manually.	[Protection Para /Global Prot Para /Bkr Manager /Bkr[1]]
Ready-I	Module Input State: Breaker Ready	[Protection Para /Global Prot Para /Bkr Manager /Bkr[1]]

Breaker (Manager) Signals (Outputs States)

Name	*Description*
TripCmd	Signal: Trip Command
Ack TripCmd	Signal: Acknowledge Trip Command
State	Signal: Breaker Position (0 = Indeterminate, 1 = OPEN, 2 = CLOSE, 3 = Disturbed)
Ready	Signal: Breaker is ready for operation.
Manual OPEN	Signal: Breaker was switched off manually.
Manual CLOSE	Signal: Breaker was switched on manually.
Pos OPEN	Signal: Breaker is in OPEN-Position
Pos CLOSE	Signal: Breaker is in CLOSE-Position
Pos Indeterm	Signal: Breaker is in Indeterminate Position
Pos Disturb	Signal: Breaker Disturbed - Undefined Breaker Position. The Position Indicators contradict themselves. After expiring of a supervision timer this signal becomes true.

Breaker Wear

BWear[1] ,BWear[2]

Principle – General Use

The sum of the accumulated interrupted currents are monitored by the Breaker Wear Module.

Device Planning Parameters of the Breaker Wear Module

Parameter	*Description*	*Options*	*Default*	*Menu Path*
Mode	Mode	Do not use, Use	Use	[Device Planning]

Global Protection Parameters of the Breaker Wear Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Winding Side	Winding Side	BWear[1]: W1 BWear[2]: W2	BWear[1]: W1 BWear[2]: W2	[Protection Para /Global Prot Para /Bkr Manager /BWear[1]]
Bkr	Selection of the Breaker to be monitored.	BWear[1]: Bkr[1] BWear[2]: Bkr[2]	BWear[1]: Bkr[1] BWear[2]: Bkr[2]	[Protection Para /Global Prot Para /Bkr Manager /BWear[1]]
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Bkr Manager /BWear[1]]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Bkr Manager /BWear[1]]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Function	Permanent activation or deactivation of module/element.	Inactive, Active	Inactive	[Protection Para /Global Prot Para /Bkr Manager /BWear[1]]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo Fc=active".	Inactive, Active	Inactive	[Protection Para /Global Prot Para /Bkr Manager /BWear[1]]
Operations Alarm	Service Alarm, too many Operations	1 - 65535	100	[Protection Para /Global Prot Para /Bkr Manager /BWear[1]]
Isum Intr Alarm	Alarm, the Sum (Limit) of interrupting currents has been exceeded.	0 - 2500000A	70000A	[Protection Para /Global Prot Para /Bkr Manager /BWear[1]]

Breaker Wear Input States

Name	*Description*	*Assignment Via*
ExBlo1-I	Module Input State: External Blocking1	[Protection Para /Global Prot Para /Bkr Manager /BWear[1]]
ExBlo2-I	Module Input State: External Blocking2	[Protection Para /Global Prot Para /Bkr Manager /BWear[1]]

Breaker Wear Signals (Output States)

Name	*Description*
Active	Signal: Active
ExBlo	Signal: External Blocking
Operations Alarm	Signal: Service Alarm, too many Operations
Isum Intr trip: IA	Signal: Maximum permissible Summation of the interruppting (tripping) currents exceeded: IA
Isum Intr trip: IB	Signal: Maximum permissible Summation of the interruppting (tripping) currents exceeded: IB
Isum Intr trip: IC	Signal: Maximum permissible Summation of the interruppting (tripping) currents exceeded: IC
Isum Intr trip	Signal: Maximum permissible Summation of the interruppting (tripping) currents exceeded in at least one phase.
Res TripCmdCr	Signal: Resetting of the Counter: total number of trip commands
Res Isum trip	Signal: Reset summation of the tripping currents

Breaker Wear Counter Values

Value	*Description*	*Menu Path*
TripCmd Cr	Counter: Total number of trips of the switchgear (breaker, load break switch…).	[Operation /Count and RevData /BWear[1]]

Breaker Wear Values

Value	*Description*	*Default*	*Size*	*Menu Path*
Isum trip IA	Summation of the tripping currents phase1	0A	0 - 65535A	[Operation /Count and RevData /BWear[1]]
Isum trip IB	Summation of the tripping currents phase2	0A	0 - 65535A	[Operation /Count and RevData /BWear[1]]
Isum trip IC	Summation of the tripping currents phase3	0A	0 - 65535A	[Operation /Count and RevData /BWear[1]]

Direct Commands of the Breaker Wear Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Res TripCmdCr	Resetting of the Counter: total number of trip commands	Inactive, Active	Inactive	[Operation /Reset]
Res Isum trip	Reset summation of the tripping currents	Inactive, Active	Inactive	[Operation /Reset]

Differential Protection [87]

Phase Current Differential Protection

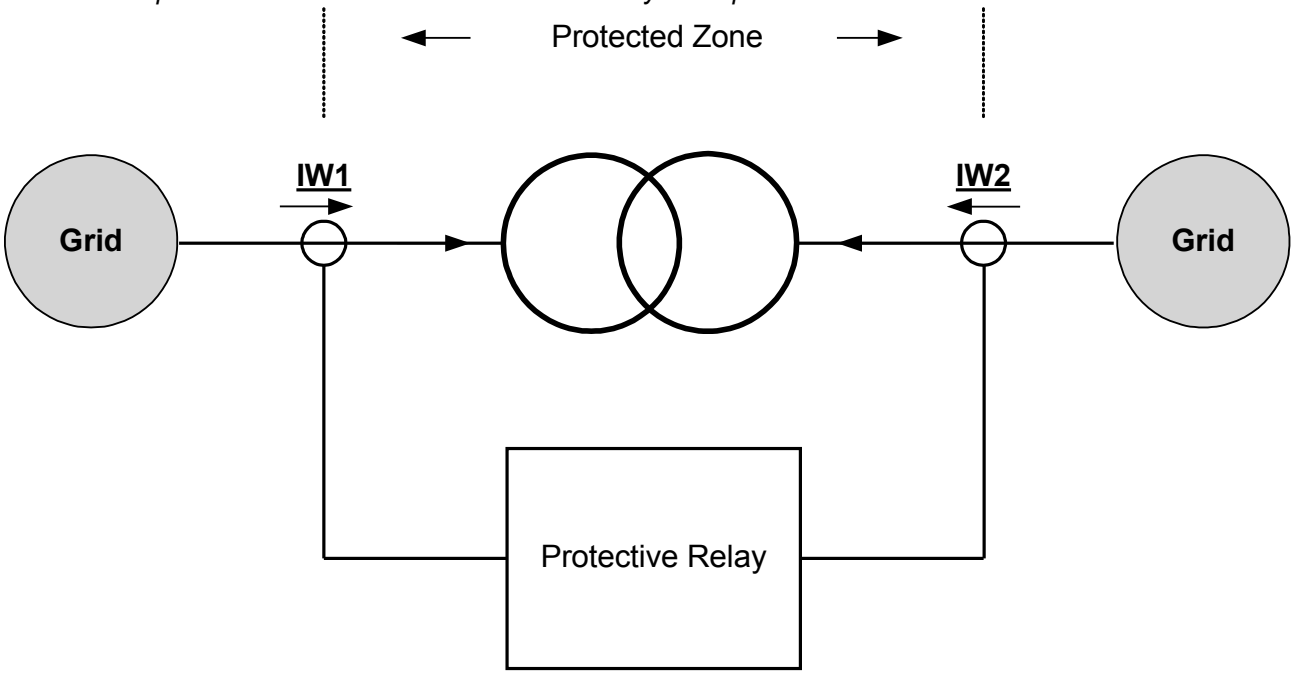
Elements:
87

Description
The protective device provides phase restrained differential protection function with the User-configurable multiple slope percentage restrained characteristic that allows the User to compensate both the static error and the dynamic error. The static error accounts for transformer magnetizing current and current measurement circuit calibration errors. The dynamic error may be caused by CT ratio mismatch due to tap changing and by CT secondary currents falsely representing their primary currents due to the increased magnetizing current caused by fault current.

The dynamic error is proportional to the fundamental restraining current. In addition, the static tripping characteristic can be temporarily modified at the User's choice to prevent some nuisance tripping from the harmonic inrush during energization, over-excitation, or deep CT saturation. The harmonic inrush is evaluated through 2nd, 4th, and 5th harmonics and the transient is monitored through the CT saturation detector.

The direction convention adopted here is as shown in the following drawing.

Protection Principle of the Current Differential Protection by Example of a Two-sided Fed Transformer.



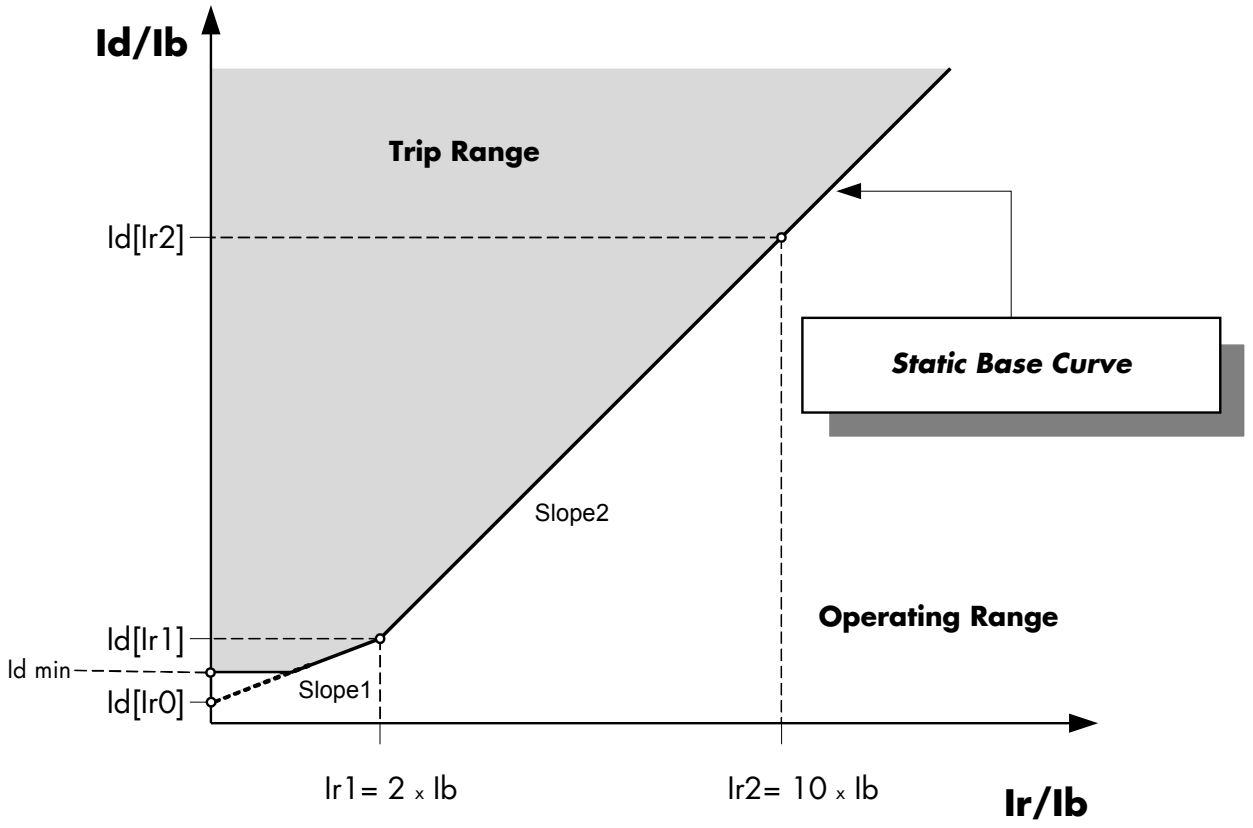
The phase restrained percentage differential protection tripping characteristic can mathematically be expressed as:

$$\left|\vec{I}_d\right| \geq \left|\overrightarrow{I_{dmin}}\right| + \underbrace{K_1 * \left|\vec{I}_r\right|}_{Ir > I_{dmin} \text{ and } Id < 2 * I_b} + \underbrace{K_2 * \left|\vec{I}_r\right|}_{I_r \geq 2 * I_b} + d(H, m)$$

Where $\left|\vec{I}_d\right| = \left|\overrightarrow{I_{W1}}'' + \overrightarrow{I_{W2}}''\right|$ is defined as the fundamental differential current.
$\overrightarrow{I_{W1}}$ and $\overrightarrow{I_{W2}}$ are uncompensated winding primary phase current phasors.
$\overrightarrow{I_{W1}}''$ and $\overrightarrow{I_{W2}}''$ are the compensated phase current phasors of winding 1 and winding 2.

Under normal conditions, the differential current should be below $\left|\overrightarrow{I_{dmin}}\right|$. When an internal fault occurs, the different current will raise above the restraining current to trip. To establish this trip criterion, two winding currents must be matched by compensating their magnitudes and phases.

$|\vec{I}_r| = 0.5 * |\vec{I}_{W1}'' - \vec{I}_{W2}''|$ is the fundamental restraining current, and it is also called the through current for normal load and external faults. $d(H, m)$ is the temporary restraining current, which is a configurable multiple of the base current I_b .



Setting the Tripping Curve

$|\vec{I}_{dmin}|$ is the minimum differential current multiple scaled to the base current in order for the phase restrained differential protection to trip, which should be set based on the static error (no load error, transformer magnetizing current, and measurement circuit noise). K_1 and K_2 are the restraining slopes that can be determined with the settings $I_d(|\vec{I}_{r0}|)$, $I_d(|\vec{I}_{r1}|)$, and $I_d(|\vec{I}_{r2}|)$ that are expressed as multiples of the base current.

$$K_1 = |I_d(|\vec{I}_{r1}|) - I_d(|\vec{I}_{r0}|)| / 2$$

$$K_2 = |I_d(|\vec{I}_{r2}|) - I_d(|\vec{I}_{r1}|)| / 8$$

The base currents can be obtained from the transformer power rating (»*SN*«, MVA) and voltage ratings (»*TrVLL,*« line to line voltage).

The base currents are defined as:

$$I_{b,W1} = \frac{S_N}{\sqrt{3}\, TrV_{LLW1}} \qquad I_{b,W2} = \frac{S_N}{\sqrt{3}\, TrV_{LLW2}}$$

NOTICE **For settings the tripping characteristics of the 87 Differential Protection, the base current $I_b = I_{b,W1}$ is to be used.**

The procedures to configure: $I_d(|\overrightarrow{I_{r0}}|)$, $I_d(|\overrightarrow{I_{r1}}|)$, and $I_d(|\overrightarrow{I_{r2}}|)$:

1. Use $I_d(|\overrightarrow{I_{r0}}|)$ as a minimum restraining current multiple when the differential current is zero;
2. Select the slope K_1 (usually around 15%-40% [typically 25%]);
3. $I_d(|\overrightarrow{I_{r1}}|)=I_d(|\overrightarrow{I_{r0}}|)+2*K_1$;
4. Select the slope K_2 (usually around 40%-90% [typically 60%]); and
5. $I_d(|\overrightarrow{I_{r2}}|)=I_d(|\overrightarrow{I_{r1}}|)+8*K_2$.

Magnitude Compensation

The compensated phase current phasor calculations are performed automatically and involve amplitude and phase adjustments based on the system parameters, voltage ratings, tap position (assuming the tap changer is on the winding 1 side), winding connections and groundings, and the secondary winding phase shift (n) relative to the primary.

$$\overrightarrow{I_{W2}}'=\frac{V_{LLW2}}{V_{LLW1*(1+\%Tap)}}*T_{PhaseShift(n)}*(\frac{CT2_{Pri}}{CT2_{Sec}}*\overrightarrow{I_{W2}})$$

Since the winding 1 is taken as the reference $\overrightarrow{I_{W1}}'=(\frac{CT1_{Pri}}{CT1_{Sec}}*\overrightarrow{I_{W1}})$, $\overrightarrow{I_{W1}}$ and $\overrightarrow{I_{W2}}$ are uncompensated secondary winding phase current phasors.

CT Mismatch

NOTICE **None of the Amplitudes Matching factors must exceed a value of 10.**

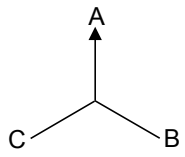
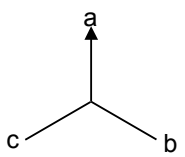
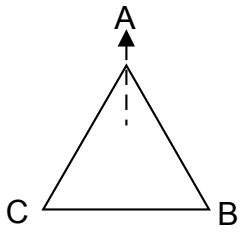
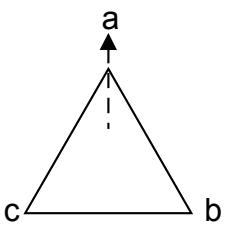
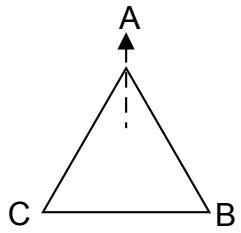
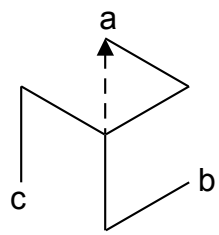
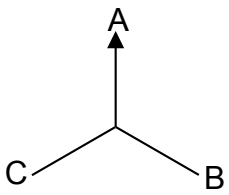
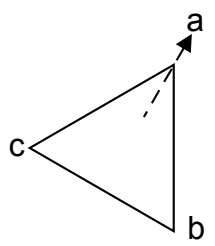
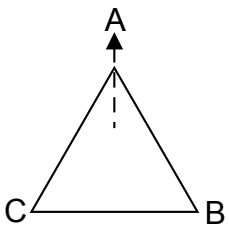
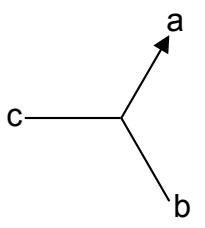
$$k_{CT1}=\frac{CT1_{Pri}}{Ib_{W1}}\leqslant 10 \quad \textbf{and} \quad k_{CT2}=\frac{CT1_{Pri}}{Ib_{W2}}\leqslant 10$$

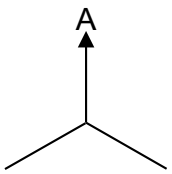
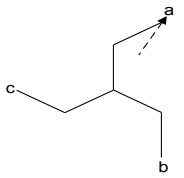
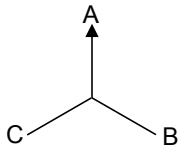
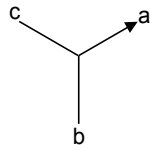
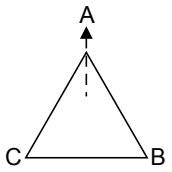
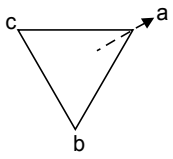
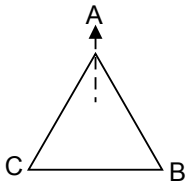
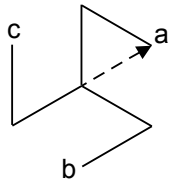
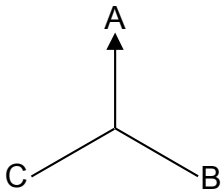
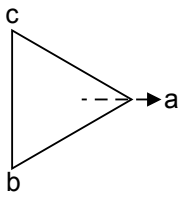
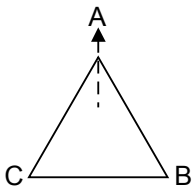
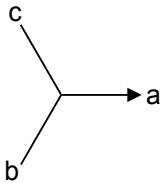
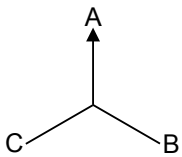
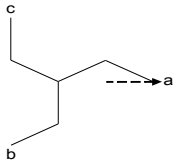
In addition, the second largest amplitudes matching factor must be greater than 0.5

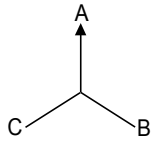
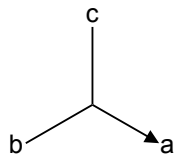
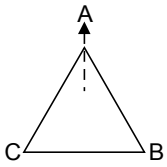
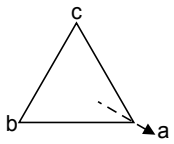
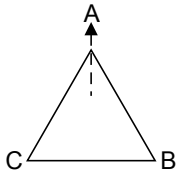
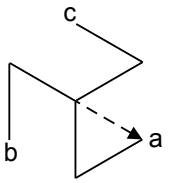
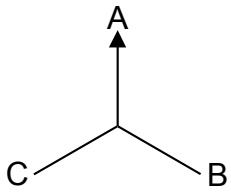
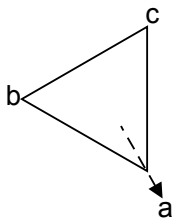
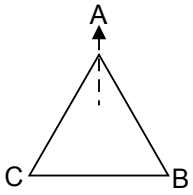
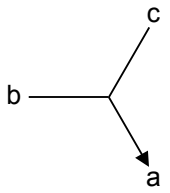
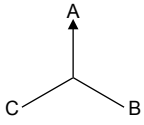
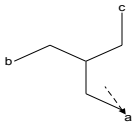
The ratio between the maximum and second largest must not exceed a value of 3.

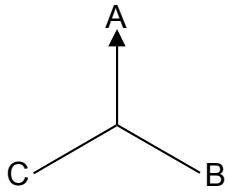
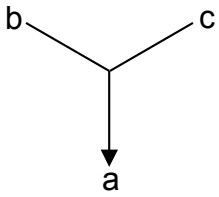
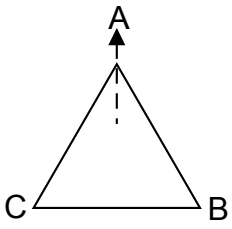
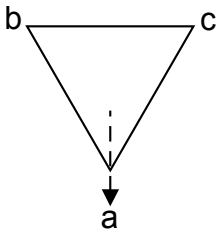
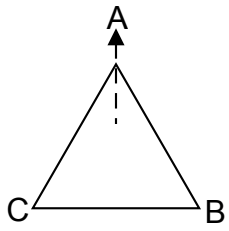
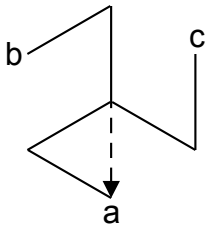
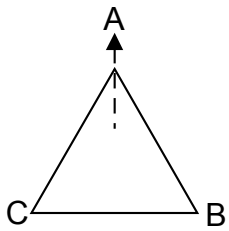
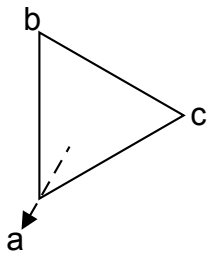
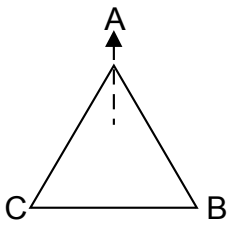
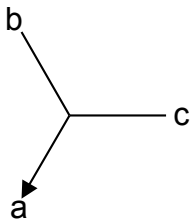
Phase Compensation (ABC Phase System)

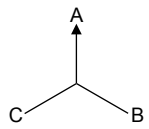
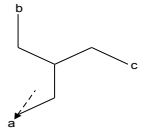
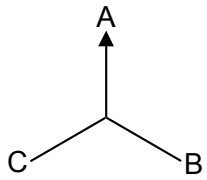
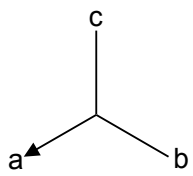
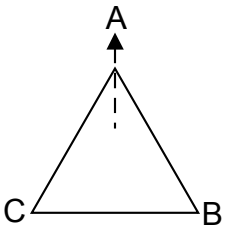
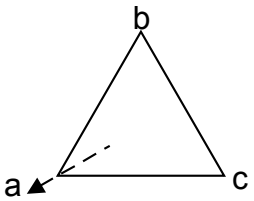
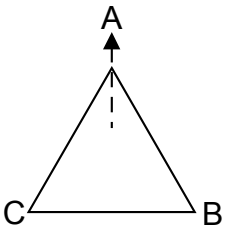
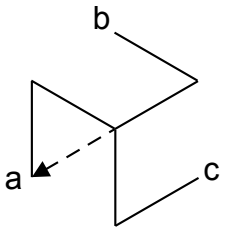
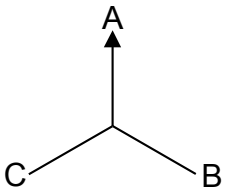
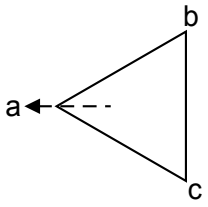
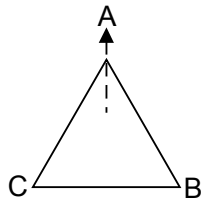
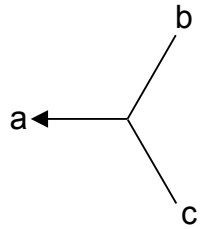
Note that the phase shift n is specified as a multiple of -30°. A positive n means the secondary is lagging the primary side. The User must carefully select the right number based on the winding connections. The following table lists the typical transformer connection types and their corresponding phase shifts for ABC phase sequence.

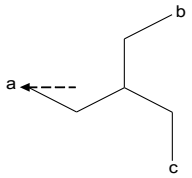
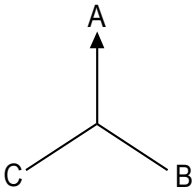
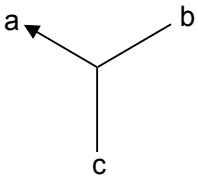
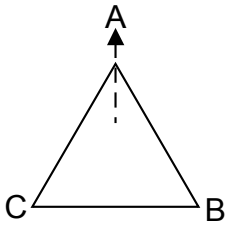
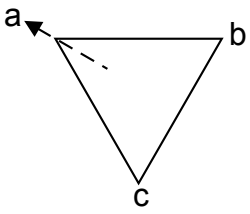
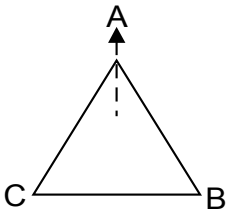
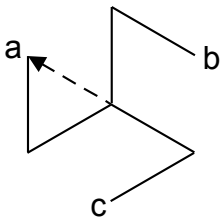
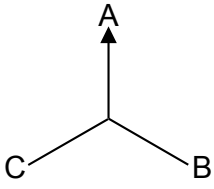
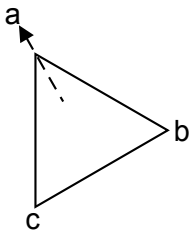
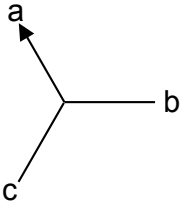
Vector Group	*Phase Shift*	*Transformer Connection Type*	*Winding 1 Connection*	*Winding 2 Connection*
0	0°	Yy0		
		Dd0		
		Dz0		
1	30°	Yd1		
		Dy1		

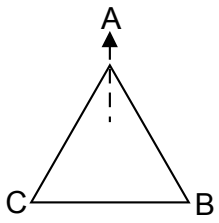
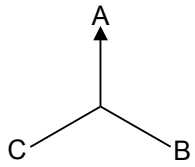
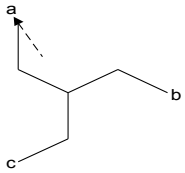
		Yz1		
2	60°	Yy2		
		Dd2		
		Dz2		
3	90°	Yd3		
		Dy3		
		Yz3		

4	120°	Yy4		
		Dd4		
		Dz4		
5	150°	Yd5		
		Dy5		
		Yz5		

Vector Group	*Phase Shift*	*Transformer Connection Type*	*Winding 1 Connection*	*Winding 2 Connection*
6	180°	Yy6		
		Dd6		
		Dz6		
7	210°	Yd7		
		Dy7		
		Yz7		

Vector Group	Phase Shift	Transformer Connection Type	Winding 1 Connection	Winding 2 Connection
				
8	240°	Yy8		
		Dd8		
		Dz8		
9	270°	Yd9		
		Dy9		

Vector Group	Phase Shift	Transformer Connection Type	Winding 1 Connection	Winding 2 Connection
		Yz9		
10	300°	Yy10		
		Dd10		
		Dz10		
11	330°	Yd11		
		Dy11		

Vector Group	*Phase Shift*	*Transformer Connection Type*	*Winding 1 Connection*	*Winding 2 Connection*
				
		Yz11		

Phase Compensation (ACB Phase System)

The phase shift n for the ACB phase sequence should be 12's complement to the corresponding transformer connection type. For instance, Dy5 for the ABC phase sequence will be Dy7 (12-5) for the ACB sequence, Dy11 becomes Dy1, and so on.

Zero Sequence Removal

Zero sequence currents must be removed to prevent the phase differential protection from tripping on external ground faults. The protective device does not require the zero sequence currents to be removed externally and they will be automatically removed internally if their neutrals are grounded based on the system parameters »*W1 Connection/Grounding*« and »*W2 Connection/Grounding*«.

$$\overrightarrow{I_{W1}}'' = \overrightarrow{I_{W1}}' - \overrightarrow{I_{0,W1}}'$$

$$\overrightarrow{I_{W2}}'' = \overrightarrow{I_{W2}}' - \overrightarrow{I_{0,W2}}'$$

Retrofitting – External Compensation

CAUTION **By using the external removal approach, the relay will not see the zero sequence current on which other functions, such as residual over-current functions, ground differential function, etc., will be stopped.**

For a retrofit project, if the User has CTs externally connected in such a way that the zero sequence currents are automatically removed, then the internal zero sequence currents compensation will not be needed. However, if the User prefers the external approach of zero sequence current removal, the User must be aware that the protective device is a multi-function, digital protection system and the phase differential function is one of them. By using the external removal approach, the relay will not see the zero sequence current on which other functions such as residual over-current functions, ground differential function, etc., will be stopped. If the User is only interested in the phase differential function in this relay, close attention must be paid to the phase shift and CT ratios. Under normal or external fault conditions, the CT secondary currents from two windings should be equal in magnitude, i.e.:

$$\left|\frac{CT1_{Sec}}{CT1_{Pri}/\sqrt{3}} * \overrightarrow{I_{W1}}\right| = \left|\frac{CT2_{Sec}}{CT2_{Pri}} * \overrightarrow{I_{W2}}\right|$$ if the winding 1 CTs are delta-connected; or

$$\left|\frac{CT1_{Sec}}{CT1_{Pri}} * \overrightarrow{I_{W1}}\right| = \left|\frac{CT2_{Sec}}{CT2_{Pri}/\sqrt{3}} * \overrightarrow{I_{W2}}\right|$$ if the winding 2 CTs are delta-connected.

The User must provide the relay with the modified CT primary rating to accommodate the current's effective decrease due to the CT delta connection. The CT primary rating setting on the CT delta connected side should be divided by $\sqrt{3}$.

The phase shift n for the CT delta connected case should include the phase shift from transformer winding connections and additional phase shift from CT delta connection. There are only two methods for the CT delta connection:

•DAB (dy1); or
•DAC (dy11).

For instance, if the User has a Yd1 transformer and the neutral on the Y side is grounded, the User must have CTs on the Y side connected as DAC (Dy11), then the User has total phase shift 1+11=12 (same as 0 in terms of phase shift). If the User has a Yd5 transformer and the neutral on the Y side is grounded, the User must have CTs on the Y side connected as DAB (Dy1), then the User has total phase shift 5+1=6.

Transformer Winding Connection Type	*CT Delta Connection Type on Y or y side*	*Total Phase Shift Multiple n*
Dy1	DAC (Dy11)	12 (0)
Dy5	DAB (Dy1)	6
Dy7	DAC (Dy11)	(18 % 12) =6
Dy11	DAB (Dy1)	12 (0)
Yd1	DAC (Dy11)	12 (0)
Yd5	DAB (Dy1)	6
Yd7	DAC (Dy11)	(18 % 12) =6
Yd11	DAB (Dy1)	12 (0)

Once a correct phase shift n is selected, the phase compensation calculations are done automatically using the corresponding phase shifting matrix listed in the table.

Temporarily Restraining

The transient behavior can be evoked by:

1. Directly energizing the transformer (inrush effect);
2. Sympathetic inrush current sharing due to adjacent transformer energization; and/or
3. Saturation of the CT.

Temporarily restraining can be triggered by:

1. 2nd harmonic trigger is enabled and the percentage of the 2nd harmonic exceeds its threshold;
2. 4th harmonic trigger is enabled and the percentage of the 4th harmonic exceeds its threshold;
3. 5th harmonic trigger is enabled and the percentage of the 5th harmonic exceeds its threshold; or
4. CT saturation trigger is enabled and saturation is detected.

NOTICE **By means of the »*Block mode*« (Cross Block), the User can specify if an harmonic signal or CT saturation within one phase temporarily causes restraining within this phase only or a cross block (3 phases).**

Temporarily Restraining (by monitoring of the harmonics)

The protective device also offers the temporary restraining feature for further securing phase restrained percentage differential protection against harmonics and other transients such as CT saturation. Separating the temporary restraining from the fundamental restraining can make the differential protection more sensitive to internal faults and more secure when harmonics or other transients occur. The temporary restraining, whenever effective, will essentially add a constant $d(H,m)$ to the fundamental restraining. Graphically, the static tripping curve is temporarily raised by $d(H,m)$. The amount of the temporary restraining is configured as multiple of the base current I_b. The 2nd, 4th, and 5th harmonics percentage relative to fundamental and CT saturation can trigger the temporary restraining. For each harmonic trigger function to be effective, it must be enabled and the percentage of the harmonic over fundamental must exceed its threshold.

Moreover, for the 2nd and 5th harmonics trigger functions, they can be independently configured as having different trigger levels for transient and stationary harmonics. The transient restraining will be effective for a specified t-Trans beginning with energization, which should be set according to the time duration expected for inrush (IH2) currents. For example, this can vary from around 1 second up to nearly 30 seconds for special applications like auto-transformer banks.

The stationary harmonic restraining will take place after t-Trans for time as long as one of the stationary harmonic triggers is active.

Temporarily Restraining (by CT saturation monitoring)

Beside the harmonic temporary restraining triggers, the protective device offers another trigger function - the Transients Monitor (Gradient Monitor). This monitor supervises the current transformer saturation. This monitor will be triggered by the behavior of the phase currents (their slopes, normalized derivative).

The normalized derivative is defined as:

$$m = \frac{1}{\omega * I_{peak}} * \frac{di}{dt} \quad ,$$

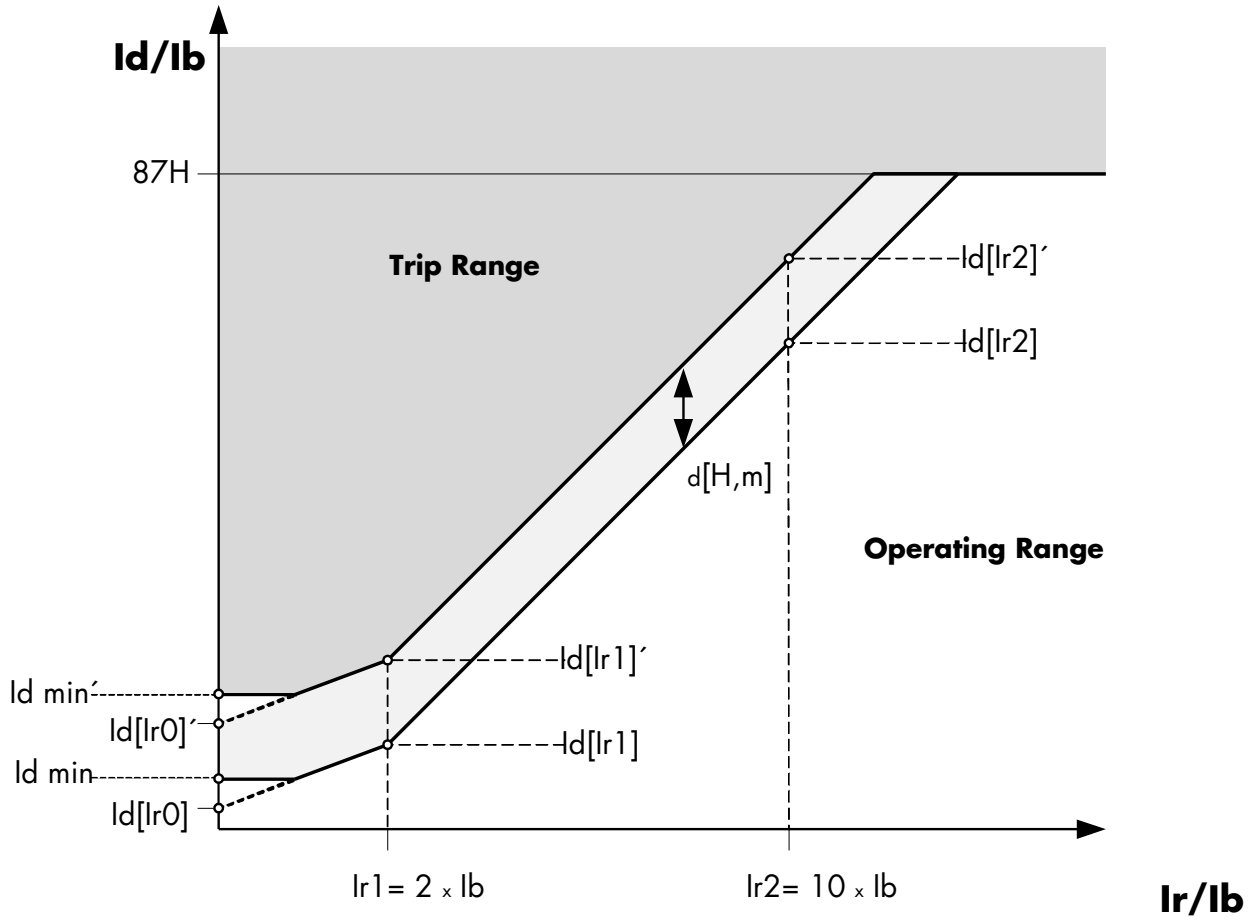
where I_{peak} is the peak value within a half cycle and ω is the system frequency.

For a pure sinusoidal waveform, the normalized derivative should be equal to 1. Under CT saturation, m will be greater than 1. The setting CT Satur Sensitvn should be set properly to effectively identify CT saturation but not to generate a nuisance trigger.

When the CT saturation monitor is active, it will trigger the temporary restraining if m exceeds an internal threshold. The temporary restraining, whenever effective, will essentially add a constant $d(H,m)$ to the fundamental restraining. Graphically, the static tripping curve is temporarily raised by $d(H,m)$ by which the sensitivity of the differential protection function is temporarily reduced.

The internal threshold can be modified by means of the CT Saturation Sensitivn. The CT saturation monitor will behave more sensitively the lower the setting value is set.

Temporary Dynamic Rise of the Static Tripping Characteristic.



NOTICE

The following signals cannot become true if Id<Idmin:

87. Slope Blo
87. H2,H4,H5 Blo
87. Blo H2
87. Blo H4
87. Blo H5
87. Restraining

The signal restraining will become true if "87. Slope Blo" or "87. H2,H4,H5 Blo" is true.

Example on Setting the Differential Function

Setting the differential module will be described here with focus on the differential functionality.

Please note:

•All other functionality and settings are the same for this example;
•Configuring the blocking,
•Routing the trip command, and

•Device planning.

•Others are to be treated as described for other modules and in general in this document.

The protective device asks for nearly all type-plate data of the transformer to allow for optimal adjustment of the differential function without the need of an auxiliary transformer and other tools like CT tapping (especially that known from non-digital relays in the past).

This results in the fact that the relay automatically takes these numeric values into account:

•CT ratio and its deviation from full load amperage at each winding of the transformer;
•Transformer ratio with respect to amplitude and transformer vector-group; and
•Ratio change by tap changer displacement.

All this is internally compensated for by numeric means.

SN:
Nominal, rated capacity of the transformer - basis for calculating the full load amperage of the transformer.

Example
78 MVA

TrV W1:
Rated voltage of the transformer regarding winding 1.

Example
118 kV

TrV W2:
Rated voltage of the transformer regarding winding 2.

Example
14.4 kV

By means of these three settings, the following full load amperage Ib is calculated, which is defined as the full load amperage for the maximum allowed apparent power of the transformer. There is one full load amperage for each winding, but differential protection results are always displayed in relation to Ib of the winding 1.

Example:

$$Ib = \frac{78000000\,VA}{\sqrt{3} * 118000\,V} = 381\,A$$

Ib = Full load current (FLA related to the primary side)

Connection Groups

W1 Winding/Grounding
This is the setting for the connection scheme of the winding 1 and its grounding condition.

Allowed Settings	Default (example)
Y, D, Z, YN, ZN	D

W2 Winding/Grounding
This is the setting for the connection scheme of the winding 2 and its grounding condition.

Allowed Settings	Default (example)
y, d, z, yn, zn	yn

The combination of W1 Winding/Grounding and W2 Winding/Grounding allows for all possible physical connection schemes of power transformers. The N or n can be set whenever the neutral of the transformer is connected to ground and the grid on that side of the winding is grounded.

Phase Shift:
Phase shift in multiples of 0...11 * (-30) degree that the secondary voltage lags the primary voltage.

Default (example)
1 (-30 degrees)

Please refer to the Phase Compensation section for a number of typical, preferred transformer types.

For (Y, y, Z, z) connections, the neutral can be connected to ground or not connected to ground. In general, there is a distinction between odd (1, 3, 5, …, 11) and even (0, 2, 4, …,10) connection numbers. Together with the connection scheme (y, d, or z) and the treatment of the neutral of the transformer, the following characteristics can be defined for current transformation from one side of a transformer to the other (described by means of symmetrical components (I1, I2, I0) and its representation by the protective device).

- The three-phase symmetrical system I1 is rotated counter-clockwise when transferring from winding 1 to winding 2 (applies for ABC phase sequence).
- The three-phase symmetrical system I2 is rotated clockwise when transferring from winding 1 to winding 2. (applies for ABC phase sequence).
- The connection of the transformer to a negative rotating system (ACB) is taken into account according to the parameter.
- The transformation of the zero sequence system I0 depends on the connection of the windings:
  - Only (Y, y, Z, z) – connections provide for an externally available neutral point;
  - Only when this neutral point is connected to ground, and at least another ground connection is available on the grid to which the winding is connected (a zero sequence - respectively ground current can flow); and
  - Only when both windings of the transformer allow for ground current flowing, the zero sequence current can be transformed from one side of the transformer to the other without any phase shift.
- Odd connection groups are created by Dy, Yd, Yz, Zy schemes.
- Even connection groups are created by Yy, Zd, Dz, Dd.
- The primary values of winding 1 are reference values when displaying or evaluating relative values.

This primary voltage level is adapted using an on load tap changer.

Tap Changer:
The tap changer changes the transformer voltage ratio k_{Tap} .

$$k_{Tap} = \frac{TrV\ W1\,(1 + TapChanger\% / 100\%)}{TrV\ W2}$$

Default (example)
14.4 kV

Principally, the following calculations need to be executed before calculating differential values and restraining values of the transformer differential protection:

- Rotating the measured values of winding 2 to the reference system independent from the count-clockwise rotation number (0, 1, …..11) * 30 degrees;
- Adjustment of measured values for winding 2 with respect to CT ratio mismatch;
- Adjustment of measured values for winding 2 with respect to winding connection (y, d, z); and
- Adjustment of measured values for winding 1 and winding 2 according to neutral connection and ground treatment (zero sequence current elimination).

Automatic Calculations: Amplitudes, Vector Groups, and Zero Sequence Removal

The calculations performed can be done by matrix calculations. Three steps have to be completed.

1. Adjust the amplitude according to all transformation ratios (power transformer and CTs).
2. Adjust the vector group angle by rotating the three-phase system accordingly.
3. Remove the zero sequence current where necessary (this being valid for winding 1 and winding 2).

1. Amplitude Adjustment:

$$I'_{W2_{A,B,C}} = I_{W2_{A,B,C}} * k_r \qquad k_r = \frac{CT_{pri,W2}}{I_{fla,W2}} * \frac{I_{fla,W1}}{CT_{pri,W1}} = \frac{CT_{pri,W2}}{CT_{pri,W1}} * \frac{TrV_{W2}}{TrV_{W1} * (1 + \partial Tap)}$$

2. Vector Group Adjustment:

The vector group adjustment is calculated using the following formulas and transformation matrices:

$$L''_{W2_{ABC}} = \left[T_{vector\ group} \right] * L'_{W2_{ABC}} \qquad \left[T_{vector\ group} \right] \rightarrow \left[T_{0,1,2 \ldots 11} \right]$$

Even Connection Groups	Odd Connection Groups
$T_0 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$	$T_1 = \frac{1}{\sqrt{3}} * \begin{bmatrix} 1 & -1 & 0 \\ 0 & 1 & -1 \\ -1 & 0 & 1 \end{bmatrix}$
$T_2 = \begin{bmatrix} 0 & -1 & 0 \\ 0 & 0 & -1 \\ -1 & 0 & 0 \end{bmatrix}$	$T_3 = \frac{1}{\sqrt{3}} * \begin{bmatrix} 0 & -1 & 1 \\ 1 & 0 & -1 \\ -1 & 1 & 0 \end{bmatrix}$
$T_4 = \begin{bmatrix} 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{bmatrix}$	$T_5 = \frac{1}{\sqrt{3}} * \begin{bmatrix} -1 & 0 & 1 \\ 1 & -1 & 0 \\ 0 & 1 & -1 \end{bmatrix}$
$T_6 = \begin{bmatrix} -1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & -1 \end{bmatrix}$	$T_7 = \frac{1}{\sqrt{3}} * \begin{bmatrix} -1 & 1 & 0 \\ 0 & -1 & 1 \\ 1 & 0 & -1 \end{bmatrix}$
$T_8 = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 1 & 0 & 0 \end{bmatrix}$	$T_9 = \frac{1}{\sqrt{3}} * \begin{bmatrix} 0 & 1 & -1 \\ -1 & 0 & 1 \\ 1 & -1 & 0 \end{bmatrix}$
$T_{10} = \begin{bmatrix} 0 & 0 & -1 \\ -1 & 0 & 0 \\ 0 & -1 & 0 \end{bmatrix}$	$T_{11} = \frac{1}{\sqrt{3}} * \begin{bmatrix} 1 & 0 & -1 \\ -1 & 1 & 0 \\ 0 & -1 & 1 \end{bmatrix}$

3. Zero sequence removal (elimination of the ground current if this can only flow through one winding at the external asymmetrical faults and will not be transformed to the other winding).

Zero sequence removal will be calculated for the primary winding system, if the W1con value is set to YN or ZN.

A zero sequence current can only flow:

1. If the neutral is connected to ground; and
2. The grid on the primary side is grounded as well.

$$I^{*}_{W1_{A,B,C}} = I^{''}_{A,B,C} - I_0$$

For the secondary winding system:

Zero sequence removal will be calculated for the secondary winding system, if the W2con value is set to yn or zn.

A zero sequence current can only flow:

1. If the vector group is odd;
2. If the neutral is connected to ground; and
3. The grid on the secondary side is grounded as well

$$I^{'''}_{W2_{A,B,C}} = I^{''}_{W2_{A,B,C}} - I_0$$

After setting the values for the percentage restrained characteristic curve, the settings for harmonic and transient restraining have to be defined. Both the harmonic and transient restraining settings depend on many parameters:

- Transformer type;
- Transformer material;
- Operational parameter of the grid; and
- Time of energizing relative to the sinusoidal phase.

Therefor it is very difficult to give “one for all” settings in this area and to find a compromise between making a differential relay extremely fast and extremely reliable in its trip decisions.

Beginning with the static characteristic curve, typical slopes of 25% and 50% for both sections are recommended. They will be obtained by the following settings:

Id(Ir0)

Default (example)
0.2

Id(Ir1)

Default (example)
0.7

Id(Ir2)

Default (example)
5

In case of harmonic or transient restraint, the curve will be added by an offset d(H,m) - in version 1.0 a static offset.

To be able to withstand magnetizing inrush currents of typical values, the following value of d(H,m) is recommended and given per default.

d(H,m)

Default (example)
8

In case of any harmonic restraint threshold is reached, this value will be added to the characteristic curve.

It is important to estimate the necessary harmonic threshold to obtain stability against magnetizing inrush, CT saturation, and over-excitation. The harmonics seen under different operational conditions like magnetizing inrush and CT saturation depend on many different parameters.

Magnetizing inrush:
Basically, en harmonics can be observed and monitored. Due to this fact, the 2^{nd} and 4^{th} harmonic are monitored. Inrush currents depend on the time of energizing, the remnant magnetizing compared to phase of sinusoidal curve, the voltage (low voltage energizing produce less harmonic), the core material and the core geometry among others. It is generally recommended to set the harmonic restraint as active.

Stab H2

Default (example)
active

Stab H4

Default (example)
active

To operate very stably under stationary circumstances, it can be distinguished between a stationary value of harmonic thresholds and a transient harmonic threshold directly after energizing. This transient period is always started if the differential as well the restraining current is below 0.05% of the nominal CT current setting. The following values are recommended for typical cases:

H2 Sta

Default (example)
25,00%

H2 Tra

Default (example)
10,00%

H4 Sta

Default (example)
20,00%

For CT saturation, the 5th harmonic is one typical criteria. This feature also should be activated as long as CT saturation is expected due to CT dimensioning and operational current values under external faults. It has to be noted that CT saturation can only be monitored as long as there is a critical rest of the current transformed to the secondary side of the CT. For severe CT saturation, the CT can be nearly short circuited, as seen from the primary side, so that nearly no measurable current can be monitored or analyzed.

Stab H5

Default (example)
active

H5 Sta

Default (example)
30,00%

H5 Tra

Default (example)
15,00%

The so called transient time period directly after energizing strongly depends on the above mentioned influencing parameter. Time spans from nearly zero to more than 15 seconds are known for special auto-transformer banks. A typical setting of 2 s is recommended for commonly used transformers.

t-Trans

Default (example)
2 s

All harmonic-generating events can occur to a different degree in one, two, or all three phases. That is why there is a choice provided to restrain only those phases with harmonic content or restrain all three phases, which is recommended for typical application, as long as knowledge of the grid and modes of operation do not prove another choice.

Block mode

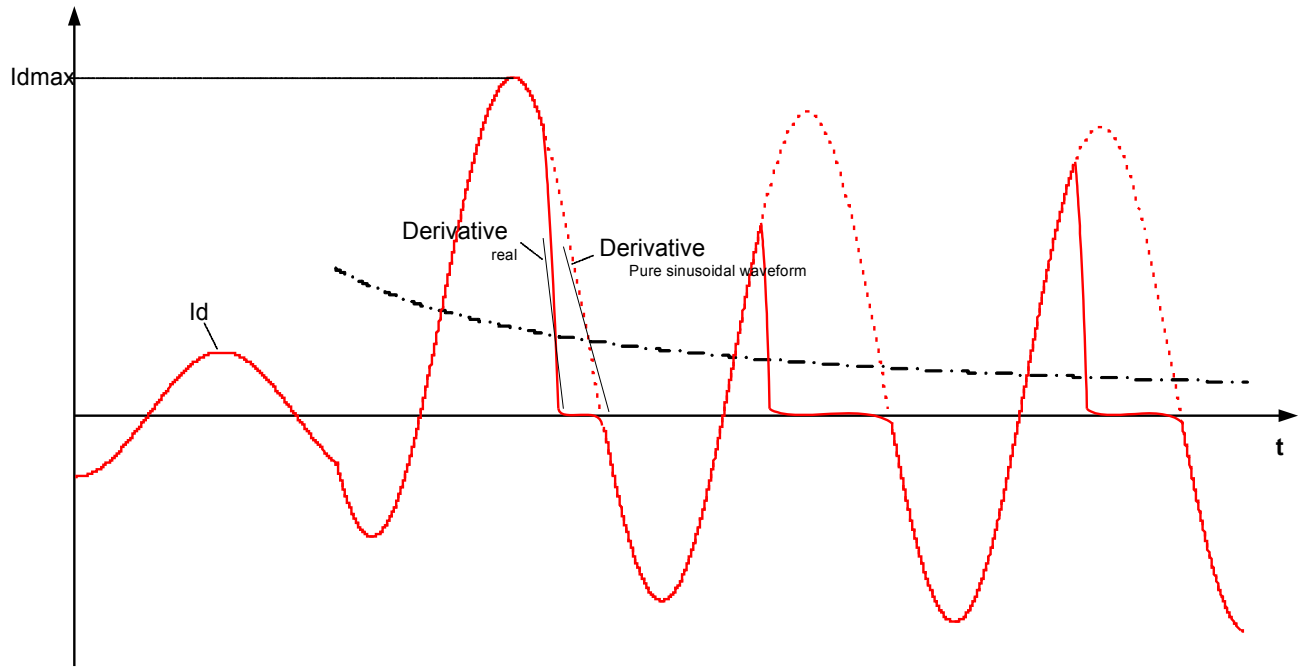
Default (example)
inactive

The Transient Monitor continuously analyzes the differential current signal. If it detects saturation (m>1 or m<-1), it will decide whether the saturation is caused by internal or external faults.

•External Faults: the sign of differential current and of slope are equal (both “-“ or both”+”).

•Internal Faults: the sign of differential current and slope are different (one “-“ and the other “+” or the other way round).

If the saturation is caused by an internal fault, there will be no raising/stabilizing of the tripping curve. If the saturation is caused by an external fault, the tripping curve will be raised by d(H,m).



CT-satur Monit

Default (example)
active

The recommended value of the CT saturation monitor is 80%.

CT Satur Sensitvn

Default (example)
80,00%

Device Planning Parameters of the Phase Current Differential Protection

Parameter	*Description*	*Options*	*Default*	*Menu Path*
Mode	Mode	Do not use, Use	Use	[Device Planning]

Global Protection Parameters of the Phase Current Differential Protection

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Tdiff-Prot /87]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Tdiff-Prot /87]
ExBlo TripCmd	External blocking of the Trip Command of the module/the element, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Tdiff-Prot /87]

Setting Group Parameters of the Phase Current Differential Protection

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Function	Permanent activation or deactivation of module/element.	Inactive, Active	Active	[Protection Para /<n> /Tdiff-Prot /87]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /Tdiff-Prot /87]
Blo TripCmd	Permanent blocking of the Trip Command of the module/element.	Inactive, Active	Inactive	[Protection Para /<n> /Tdiff-Prot /87]
ExBlo TripCmd Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo TripCmd Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /Tdiff-Prot /87]
Id min	Constant minimum pickup current (differential current).	0.1 - 1.0Ib	0.3Ib	[Protection Para /<n> /Tdiff-Prot /87]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Id(Ir0)	Measured Value (Calculated): Phase Differential Current(Starting point of the static tripping characteristic when Ir = 0)	0.0 - 1.0Ib	0.2Ib	[Protection Para /<n> /Tdiff-Prot /87]
Id(Ir1)	Measured Value (Calculated): Phase Differential Current(Breaking point of the static tripping characteristic when Ir = 2 x Ib)	0.2 - 2.0Ib	0.7Ib	[Protection Para /<n> /Tdiff-Prot /87]
Id(Ir2)	Measured Value (Calculated): Phase Differential Current(Value of the static tripping characteristic when Ir = 10 x Ib)	2.0 - 8.0Ib	5Ib	[Protection Para /<n> /Tdiff-Prot /87]
d(H,m)	Restraining factor for rising the static tripping characteristic in case of stationary or transient harmonic components, which are ascertained by Fourier analysis (H) or transients monitor (m).	0.0 - 30.0Ib	8Ib	[Protection Para /<n> /Tdiff-Prot /87]
H2 Restrain	Restraining of differential protection function against stationary or transient components of the 2nd harmonic at the phase current (e.g.: rush-effect).	Inactive, Active	Active	[Protection Para /<n> /Tdiff-Prot /87]
H2/H1 Stat	Threshold (2nd harmonic - basic wave ratio) for restraining the differential protection function against stationary 2nd harmonic.	10 - 50%	25%	[Protection Para /<n> /Tdiff-Prot /87]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
H2/H1 Trans	Threshold (2nd harmonic – basic wave ratio) for temporary restraining of the differential protection function against transient 2nd harmonic.	10 - 25%	10%	[Protection Para /<n> /Tdiff-Prot /87]
H4 Restrain	Restraining of differential protection function against stationary components of the 4th harmonic at the phase current.	Inactive, Active	Active	[Protection Para /<n> /Tdiff-Prot /87]
H4/H1	Threshold (4th harmonic - basic wave ratio) for restraining the differential protection function against stationary 4th harmonic.	10 - 50%	30%	[Protection Para /<n> /Tdiff-Prot /87]
H5 Restrain	Restraining of differential protection function against stationary or transient components of the 5th harmonic at the phase current (e.g.: transformer overexcitation).	Inactive, Active	Active	[Protection Para /<n> /Tdiff-Prot /87]
H5/H1 Stat	Threshold (5th harmonic - basic wave ratio) for restraining the differential protection function against stationary 5th harmonic.	10 - 50%	30%	[Protection Para /<n> /Tdiff-Prot /87]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
H5/H1 Trans	Threshold (5th harmonic – basic wave ratio) for temporary restraining of the differential protection function against transient 5th harmonic.	10 - 25%	15%	[Protection Para /<n> /Tdiff-Prot /87]
t-Trans	Time of temporary restraining of the differential protection function when thresholds for "H2 Tra“ and "H5 Tra“ (transient harmonic) are exceeded.	0.05 - 120.00s	2s	[Protection Para /<n> /Tdiff-Prot /87]
Block mode	Phase overlapping restraining of the differential protection function.	Inactive, Active	Inactive	[Protection Para /<n> /Tdiff-Prot /87]
CT Satur Monit	Current Transformer Saturation Supervision	Inactive, Active	Active	[Protection Para /<n> /Tdiff-Prot /87]
CT Satur Sensitvn	Sensitiveness of the Current Transformer Saturation Supervision. The higher the value, the lower the sensitiveness.	100 - 500%	100%	[Protection Para /<n> /Tdiff-Prot /87]

Phase Current Differential Protection Module Input States

Name	*Description*	*Assignment Via*
ExBlo1-I	Module Input State: External Blocking1	[Protection Para /Global Prot Para /Tdiff-Prot /87]
ExBlo2-I	Module Input State: External Blocking2	[Protection Para /Global Prot Para /Tdiff-Prot /87]
ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command	[Protection Para /Global Prot Para /Tdiff-Prot /87]

Phase Current Differential Protection Module Signals (Output States)

Name	*Description*
Active	Signal: Active
ExBlo	Signal: External Blocking
Blo TripCmd	Signal: Trip Command blocked
ExBlo TripCmd	Signal: External Blocking of the Trip Command
Alarm A	Signal: Pickup System Phase A
Alarm B	Signal: Pickup System Phase B
Alarm C	Signal: Pickup System C
Pickup	Signal: Pickup
Trip A	Signal: Trip System Phase A
Trip B	Signal: Trip System Phase B
Trip C	Signal: Trip System Phase C
Trip	Signal: Trip
TripCmd	Signal: Trip Command
Blo H2	Signal: Blocked by Harmonic:2
Blo H4	Signal: Blocked by Harmonic:4
Blo H5	Signal: Blocked by Harmonic:5
H2,H4,H5 Blo	Signal: Blocked by Harmonics (Inhibit)
Slope Blo	Signal: Differential Protection was blocked by Current Transformer Supervision (Inhibit).
Transient	Signal: Temporary restraining of the differential protection afterwards the transformer is beeing engergized.
Restraining	Signal: Restraining of the differential protection by means of rising the tripping curve.

Phase Current Differential Protection Module Values

Value	*Description*	*Menu Path*
IdA H2	Measured Value (Calculated): Differential Current Phase A Harmonic:2	[Operation /Measured Values /87]
IdB H2	Measured Value (Calculated): Differential Current Phase B Harmonic:2	[Operation /Measured Values /87]
IdC H2	Measured Value (Calculated): Differential Current Phase C Harmonic:2	[Operation /Measured Values /87]
IdA H4	Measured Value (Calculated): Differential Current Phase A Harmonic:4	[Operation /Measured Values /87]
IdB H4	Measured Value (Calculated): Differential Current Phase B Harmonic:4	[Operation /Measured Values /87]
IdC H4	Measured Value (Calculated): Differential Current Phase C Harmonic:4	[Operation /Measured Values /87]
IdA H5	Measured Value (Calculated): Differential Current Phase A Harmonic:5	[Operation /Measured Values /87]
IdB H5	Measured Value (Calculated): Differential Current Phase B Harmonic:5	[Operation /Measured Values /87]
IdC H5	Measured Value (Calculated): Differential Current Phase C Harmonic:5	[Operation /Measured Values /87]

Phase Current Differential Protection Module Statistics

Value	*Description*	*Menu Path*
IdAH2max	Maximum Value IdAH2	[Operation /Statistics /87]
IdBH2max	Maximum Value IdBH2	[Operation /Statistics /87]

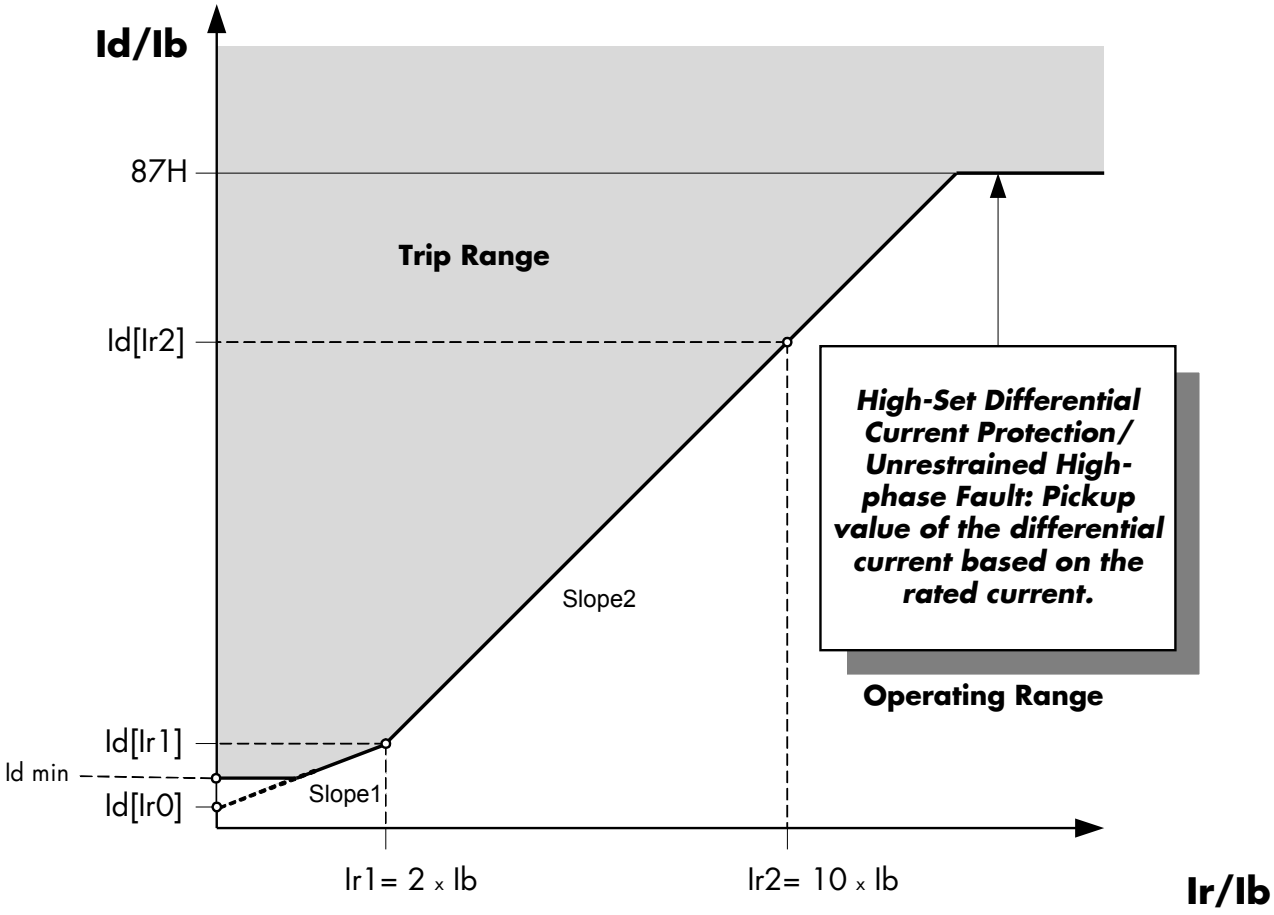
Value	*Description*	*Menu Path*
IdCH2max	Maximum Value IdCH2	[Operation /Statistics /87]
IdAH4max	Maximum Value IdAH4	[Operation /Statistics /87]
IdBH4max	Maximum Value IdBH4	[Operation /Statistics /87]
IdCH4max	Maximum Value IdCH4	[Operation /Statistics /87]
IdAH5max	Maximum Value IdAH5	[Operation /Statistics /87]
IdBH5max	Maximum Value IdBH5	[Operation /Statistics /87]
IdCH5max	Maximum Value IdCH5	[Operation /Statistics /87]

Unrestrained High-set Differential Current Protection [87H]

Elements:
87H

Irrespective of the set static tripping characteristic and restraining factors d[H,m], a pickup value for a max. differential current 87H can be adjusted and results in undelayed tripping when exceeded. This protection step is referred to as high-set differential step 87H and only trips on faults within the protection zone.

Unrestrained High-set Differential Protection Step 87H



Device Planning Parameters of the Unrestrained High-set Differential Current Protection Module

Parameter	*Description*	*Options*	*Default*	*Menu Path*
Mode	Mode	Do not use, Use	Use	[Device Planning]

Global Protection Parameters of the Unrestrained High-set Differential Current Protection Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Tdiff-Prot /87H]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Tdiff-Prot /87H]
ExBlo TripCmd	External blocking of the Trip Command of the module/the element, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Tdiff-Prot /87H]

Setting Group Parameters of the Unrestrained High-set Differential Current Protection Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Function	Permanent activation or deactivation of module/element.	Inactive, Active	Active	[Protection Para /<n> /Tdiff-Prot /87H]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /Tdiff-Prot /87H]
Blo TripCmd	Permanent blocking of the Trip Command of the module/element.	Inactive, Active	Inactive	[Protection Para /<n> /Tdiff-Prot /87H]
ExBlo TripCmd Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo TripCmd Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /Tdiff-Prot /87H]
Id>>	High-Set Differential Current Protection/Unrestrained High-phase Fault: Pickup value of the differential current based on the rated current.	2.0 - 30.0Ib	10.0Ib	[Protection Para /<n> /Tdiff-Prot /87H]

Unrestrained High-set Differential Current Protection Module Input States

Name	*Description*	*Assignment Via*
ExBlo1-I	Module Input State: External Blocking1	[Protection Para /Global Prot Para /Tdiff-Prot /87H]
ExBlo2-I	Module Input State: External Blocking2	[Protection Para /Global Prot Para /Tdiff-Prot /87H]
ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command	[Protection Para /Global Prot Para /Tdiff-Prot /87H]

Signals of the Unrestrained High-set Differential Current Protection Signals (Output States)

Name	*Description*
Active	Signal: Active
ExBlo	Signal: External Blocking
Blo TripCmd	Signal: Trip Command blocked
ExBlo TripCmd	Signal: External Blocking of the Trip Command
Alarm A	Signal: Pickup System Phase A
Alarm B	Signal: Pickup System Phase B
Alarm C	Signal: Pickup System C
Pickup	Signal: Pickup
Trip A	Signal: Trip System Phase A
Trip B	Signal: Trip System Phase B
Trip C	Signal: Trip System Phase C
Trip	Signal: Trip
TripCmd	Signal: Trip Command

Restricted Ground Fault Protection [87GD]

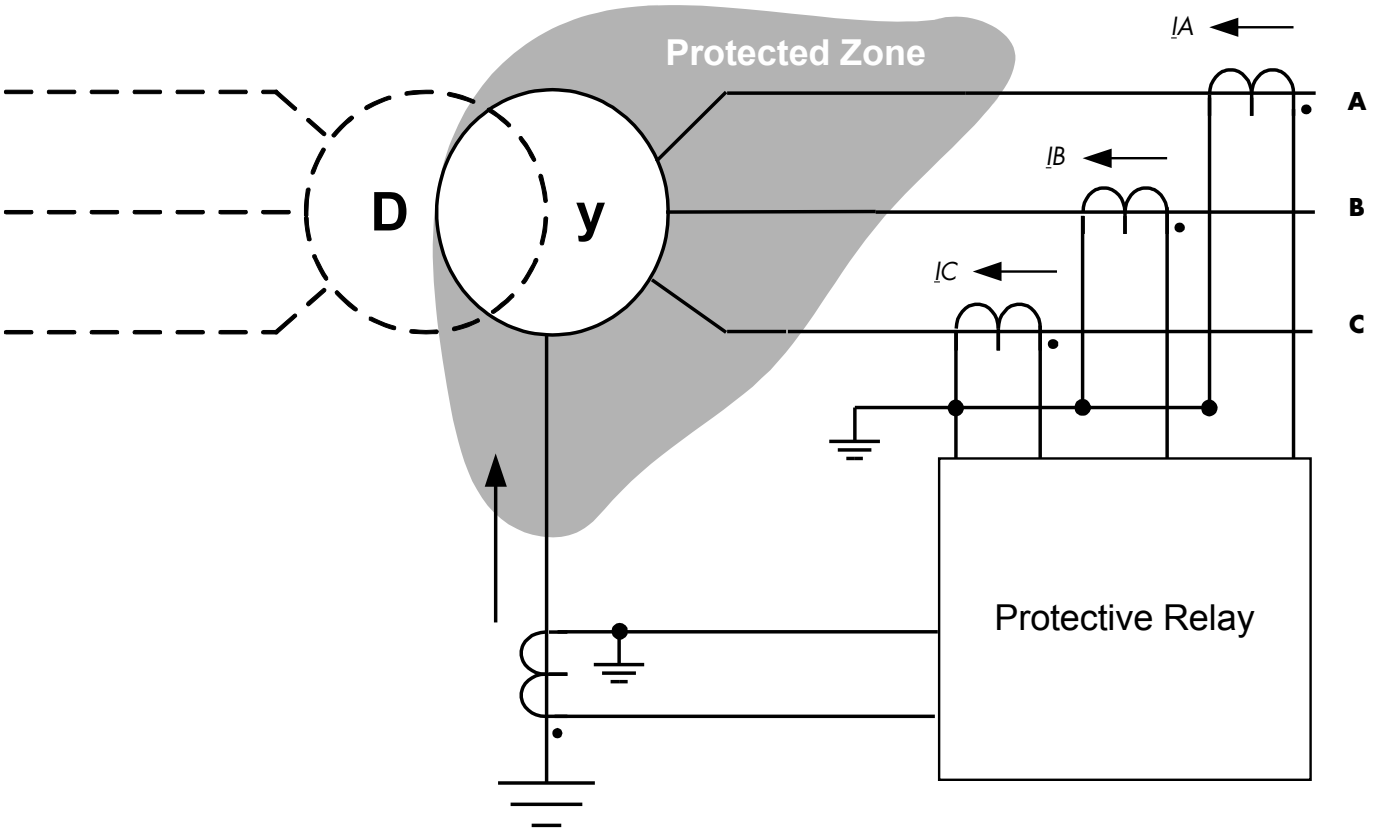
Elements
87GD[1] ,87GD[2]

This protective element protects the wye-side of transformers against ground faults that are close to the neutral.

Description
This protection principle is based on a restricted ground fault scheme that only can be used in systems with an earthed neutral. The ground differential current is the vector difference of the measured earth current and the calculated zero sequence current from three measured phase currents. Similarly to the phase restrained differential protection, the ground restraining current is the vector sum of the measured earth current and the calculated zero sequence current from three measured phase currents. The trip characteristic is very much similar to the phase restrained differential protection and it does not have the temporary restraining.

NOTICE

The accuracy of the zero current Io determination depends significantly on the tolerances of the phase current CT. This correspondingly applies to the Holmgreen Connection for measuring the earth current IG (instead by using the Toroidal-type CT), but because of its higher accuracy the Toroidal CT is to be preferred to the use of the Holmgreen Connection.



WARNING

The trip commands generated by the protective function restricted ground fault 87GD have to be assigned within the Breaker Manager.

NOTICE

Please be aware that the protective function Restricted Ground Fault 87GD solely can be applied to the winding end which builds the earthed neutral point.

Device Planning Parameters of the Restricted Ground Fault Protection

Parameter	*Description*	*Options*	*Default*	*Menu Path*
Mode	Mode	Do not use, Use	87GD[1]: Do not use 87GD[2]: Use	[Device Planning]

Global Protection Parameters of the Restricted Ground Fault Protection

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Winding Side	Winding Side	W1, W2	87GD[1]: W1 87GD[2]: W2	[Protection Para /Global Prot Para /Tdiff-Prot /87GD[1]]
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Tdiff-Prot /87GD[1]]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Tdiff-Prot /87GD[1]]
ExBlo TripCmd	External blocking of the Trip Command of the module/the element, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Tdiff-Prot /87GD[1]]

Setting Group Parameters of the Restricted Ground Fault Protection

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Function	Permanent activation or deactivation of module/element.	Inactive, Active	Inactive	[Protection Para /<n> /Tdiff-Prot /87GD[1]]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /Tdiff-Prot /87GD[1]]
Blo TripCmd	Permanent blocking of the Trip Command of the module/element.	Inactive, Active	Inactive	[Protection Para /<n> /Tdiff-Prot /87GD[1]]
ExBlo TripCmd Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo TripCmd Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /Tdiff-Prot /87GD[1]]
IdG min	Constant minimum pickup current (differential current).	0.05 - 1.00Ib	0.05Ib	[Protection Para /<n> /Tdiff-Prot /87GD[1]]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
IdG(Ir0)	Starting point of the static tripping characteristic when Ir = 0	0.00 - 1.00Ib	0.1Ib	[Protection Para /<n> /Tdiff-Prot /87GD[1]]
IdG(Ir1)	Breaking point of the static tripping characteristic when Ir = 2 x Ib	0.2 - 2.0Ib	0.2Ib	[Protection Para /<n> /Tdiff-Prot /87GD[1]]
IdG(Ir2)	Value of the static tripping characteristic when Ir = 10 x Ib	2.0 - 8.0Ib	2.0Ib	[Protection Para /<n> /Tdiff-Prot /87GD[1]]

Restricted Ground Fault Protection Module Input States

Name	*Description*	*Assignment Via*
ExBlo1-I	Module Input State: External Blocking1	[Protection Para /Global Prot Para /Tdiff-Prot /87GD[1]]
ExBlo2-I	Module Input State: External Blocking2	[Protection Para /Global Prot Para /Tdiff-Prot /87GD[1]]
ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command	[Protection Para /Global Prot Para /Tdiff-Prot /87GD[1]]

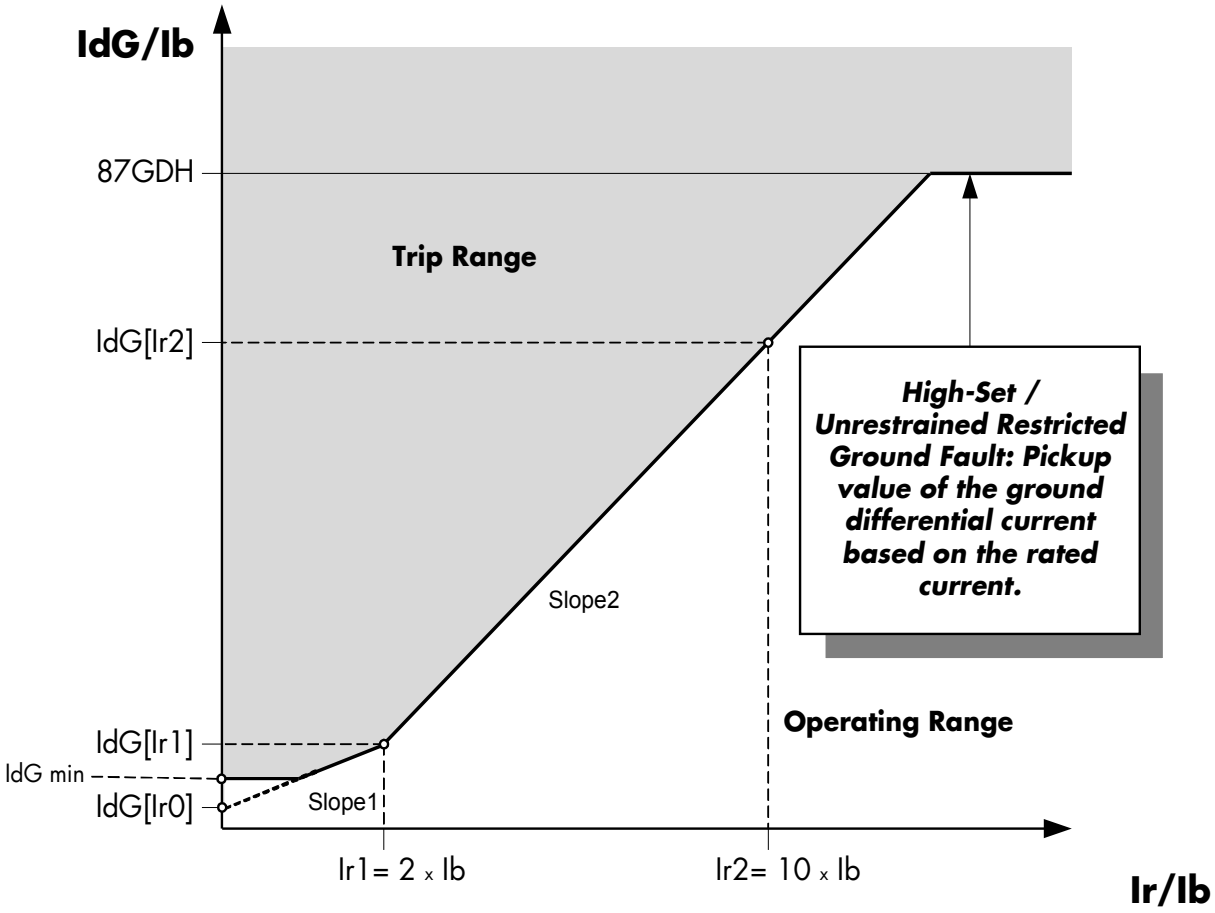
Restricted Ground Fault Protection Module Signals (Output States)

Name	*Description*
Active	Signal: Active
ExBlo	Signal: External Blocking
Blo TripCmd	Signal: Trip Command blocked
ExBlo TripCmd	Signal: External Blocking of the Trip Command
Pickup	Signal: Pickup
Trip	Signal: Trip
TripCmd	Signal: Trip Command

High Set Restricted Ground Fault Protection 87GDH

Elements
87GDH[1] ,87GDH[2]

Similar to the unrestrained phase differential protection, unrestrained ground differential protection functions are provided for a high ground differential current.



Unstabilized High Set Differential Protection Step 87GDH.

Device Planning Parameters of the High Set Restricted Ground Fault Protection Module

Parameter	*Description*	*Options*	*Default*	*Menu Path*
Mode	Mode	Do not use, Use	87GDH[1]: Do not use 87GDH[2]: Use	[Device Planning]

Global Protection Parameters of the High Set Restricted Ground Fault Protection Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Winding Side	Winding Side	W1, W2	87GDH[1]: W1 87GDH[2]: W2	[Protection Para /Global Prot Para /Tdiff-Prot /87GDH[1]]
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Tdiff-Prot /87GDH[1]]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Tdiff-Prot /87GDH[1]]
ExBlo TripCmd	External blocking of the Trip Command of the module/the element, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Tdiff-Prot /87GDH[1]]

Setting Group Parameters of the High Set Restricted Ground Fault Protection Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Function	Permanent activation or deactivation of module/element.	Inactive, Active	Inactive	[Protection Para /<n> /Tdiff-Prot /87GDH[1]]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /Tdiff-Prot /87GDH[1]]
Blo TripCmd	Permanent blocking of the Trip Command of the module/element.	Inactive, Active	Inactive	[Protection Para /<n> /Tdiff-Prot /87GDH[1]]
ExBlo TripCmd Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo TripCmd Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /Tdiff-Prot /87GDH[1]]
IdG>>	High-Set / Unrestrained Restricted Ground Fault: Pickup value of the ground differential current based on the rated current.	2.00 - 20.00Ib	2.00Ib	[Protection Para /<n> /Tdiff-Prot /87GDH[1]]

High Set Restricted Ground Fault Protection Module Input States

Name	*Description*	*Assignment Via*
ExBlo1-I	Module Input State: External Blocking1	[Protection Para /Global Prot Para /Tdiff-Prot /87GDH[1]]
ExBlo2-I	Module Input State: External Blocking2	[Protection Para /Global Prot Para /Tdiff-Prot /87GDH[1]]
ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command	[Protection Para /Global Prot Para /Tdiff-Prot /87GDH[1]]

High Set Restricted Ground Fault Signals (Output States)

Name	*Description*
Active	Signal: Active
ExBlo	Signal: External Blocking
Blo TripCmd	Signal: Trip Command blocked
ExBlo TripCmd	Signal: External Blocking of the Trip Command
Pickup	Signal: Pickup
Trip	Signal: Trip
TripCmd	Signal: Trip Command

50P- DEFT Overcurrent Protection Module [ANSI 50P]

Elements
50P[1] ,50P[2] ,50P[3] ,50P[4]

WARNING **If you are using inrush blockings, the tripping delay of the current protection functions must be at least 30 ms or more in order to prevent faulty trippings.**

NOTICE **All overcurrent protective elements are identically structured.**

For each element the following characteristics are available:

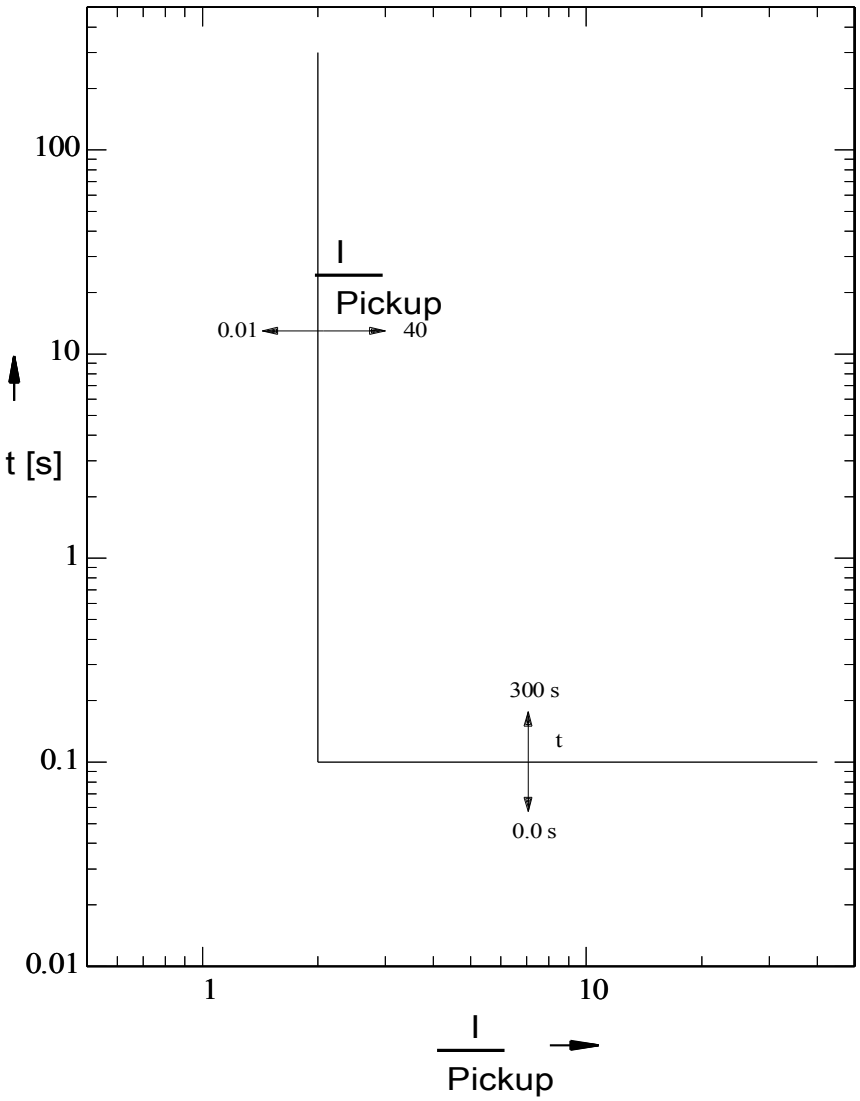
- DEFT (definite time)

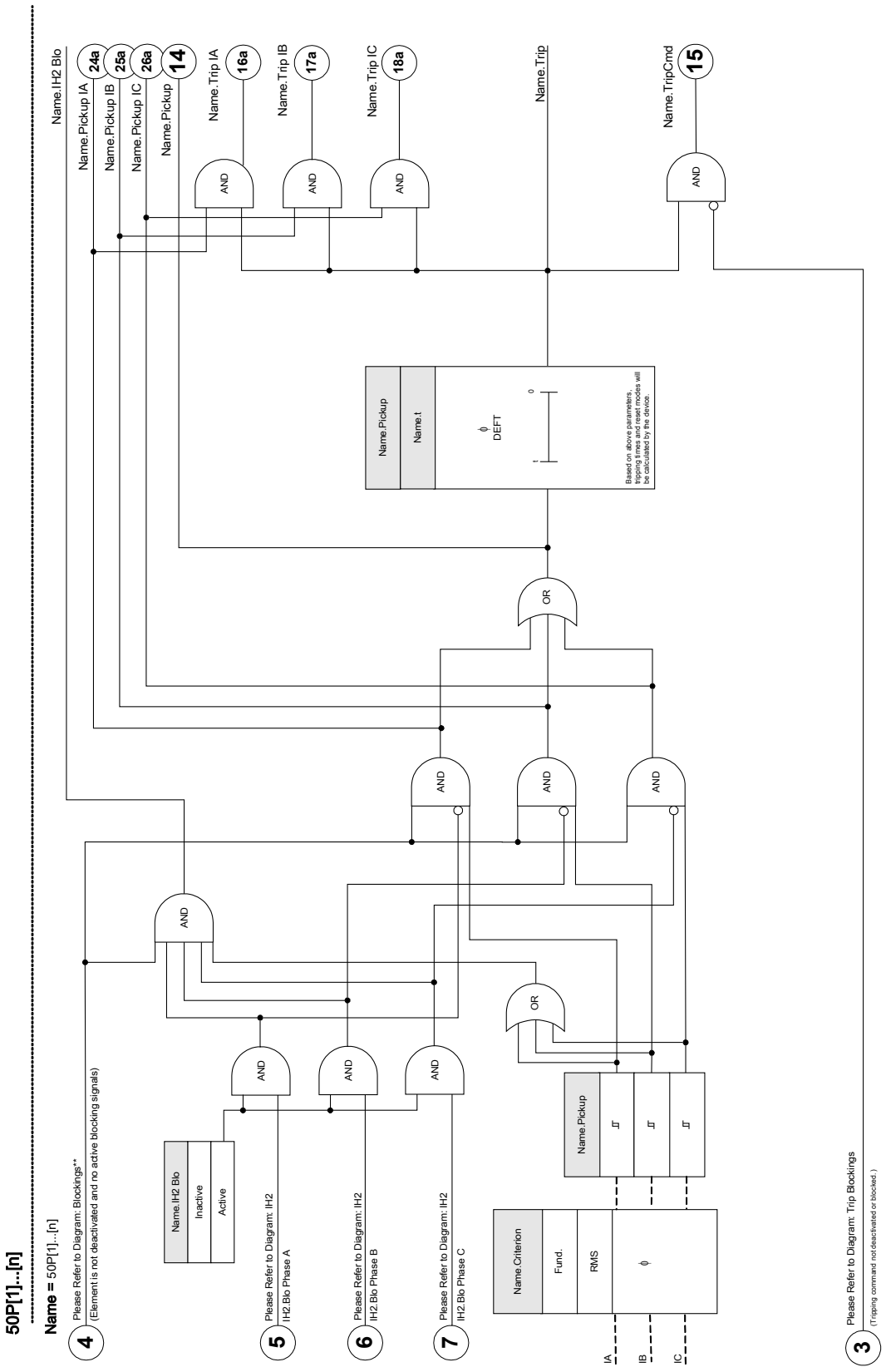
Explanation
t = Tripping delay

I = Fault current

Pickup = If the pickup value is exceeded, the module/element starts to time out to trip.

DEFT




50P[1]...[n]
Name = 50P[1]...[n]
Name.IH2 Blo
Name.Pickup IA
Name.Pickup IB
Name.Pickup IC
Name.Pickup
Name.Trip IA
Name.Trip IB
Name.Trip IC
Name.Trip
Name.TripCmd
24a
25a
26a
14
16a
17a
18a
15
AND
OR
Name.Pickup
Name.t
DEFT
Based on above parameters, tripping characteristic curves will be calculated by the device.
Name.IH2 Blo
Inactive
Active
Name.Criterion
Fund.
RMS
IA
IB
IC
4 Please Refer to Diagram: Blockings**
(Element is not deactivated and no active blocking signals)
5 Please Refer to Diagram: IH2
IH2.Blo Phase A
6 Please Refer to Diagram: IH2
IH2.Blo Phase B
7 Please Refer to Diagram: IH2
IH2.Blo Phase C
3 Please Refer to Diagram: Trip Blockings
(Tripping command not deactivated or blocked.)

Device Planning Parameters of the 50P Module

Parameter	*Description*	*Options*	*Default*	*Menu Path*
Mode	Mode	Non-directional	Non-directional	[Device Planning]

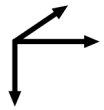
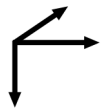
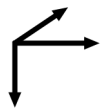
Global Protection Parameters of the 50P Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Winding Side	Winding Side	W1, W2	50P[1]: W1 50P[2]: W1 50P[3]: W2 50P[4]: W2	[Protection Para /Global Prot Para /I-Prot /50P[1]]
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /50P[1]]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /50P[1]]
ExBlo TripCmd	External blocking of the Trip Command of the module/the element, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /50P[1]]
Rvs Blo	Reverse Blocking, if Reverse Blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /50P[1]]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
AdaptSet 1	Assignment Adaptive Parameter 1	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /50P[1]]
AdaptSet 2	Assignment Adaptive Parameter 2	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /50P[1]]
AdaptSet 3	Assignment Adaptive Parameter 3	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /50P[1]]
AdaptSet 4	Assignment Adaptive Parameter 4	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /50P[1]]

Setting Group Parameters of the 50P Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Function	Permanent activation or deactivation of module/element.	Inactive, Active	50P[1]: Active 50P[2]: Inactive 50P[3]: Inactive 50P[4]: Inactive	[Protection Para /<n> /I-Prot /50P[1]]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /50P[1]]
Rvs Blo Fc	Activate (allow) or inactivate (disallow) reverse blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/element are blocked that are parameterized "Rvs Blo Fc = active".	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /50P[1]]
Blo TripCmd	Permanent blocking of the Trip Command of the module/element.	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /50P[1]]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
ExBlo TripCmd Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo TripCmd Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /50P[1]]
Criterion	Measuring method: fundamental or rms	Fundamental, True RMS	True RMS	[Protection Para /<n> /I-Prot /50P[1]]
Pickup 	If the pickup value is exceeded, the module/element starts to time out to trip. Only available if: Characteristic = DEFT Or Characteristic = INV	0.01 - 40.00In	50P[1]: 2In 50P[2]: 2.5In 50P[3]: 2.0In 50P[4]: 2.5In	[Protection Para /<n> /I-Prot /50P[1]]
t 	Tripping delay Only available if: Characteristic = DEFT	0.00 - 300.00s	50P[1]: 0s 50P[2]: 0.25s 50P[3]: 0.00s 50P[4]: 0.25s	[Protection Para /<n> /I-Prot /50P[1]]
IH2 Blo 	Blocking the trip command, if an inrush is detected.	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /50P[1]]

50P Module Input States

Name	*Description*	*Assignment Via*
ExBlo1-I	Module Input State: External Blocking1	[Protection Para /Global Prot Para /I-Prot /50P[1]]
ExBlo2-I	Module Input State: External Blocking2	[Protection Para /Global Prot Para /I-Prot /50P[1]]
ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command	[Protection Para /Global Prot Para /I-Prot /50P[1]]
Rvs Blo-I	Module Input State: Reverse Blocking	[Protection Para /Global Prot Para /I-Prot /50P[1]]
AdaptSet1-I	Module Input State: Adaptive Parameter1	[Protection Para /Global Prot Para /I-Prot /50P[1]]
AdaptSet2-I	Module Input State: Adaptive Parameter2	[Protection Para /Global Prot Para /I-Prot /50P[1]]
AdaptSet3-I	Module Input State: Adaptive Parameter3	[Protection Para /Global Prot Para /I-Prot /50P[1]]
AdaptSet4-I	Module Input State: Adaptive Parameter4	[Protection Para /Global Prot Para /I-Prot /50P[1]]

50P Module Signals (Output States)

Name	*Description*
Active	Signal: Active
ExBlo	Signal: External Blocking
Rvs Blo	Signal: Reverse Blocking
Blo TripCmd	Signal: Trip Command blocked
ExBlo TripCmd	Signal: External Blocking of the Trip Command
IH2 Blo	Signal: Blocking the trip command by IH2
Pickup IA	Signal: Pickup IA
Pickup IB	Signal: Pickup IB
Pickup IC	Signal: Pickup IC
Pickup	Signal: Pickup
Trip IA	Signal: Trip IA
Trip IB	Signal: Trip IB
Trip IC	Signal: Trip IC
Trip	Signal: Trip
TripCmd	Signal: Trip Command
Active AdaptSet	Active Adaptive Parameter
DefaultSet	Signal: Default Parameter Set
AdaptSet 1	Signal: Adaptive Parameter 1
AdaptSet 2	Signal: Adaptive Parameter 2
AdaptSet 3	Signal: Adaptive Parameter 3
AdaptSet 4	Signal: Adaptive Parameter 4

Commissioning: Overcurrent Protection, Non-directional [ANSI 50P]

Object to be tested:

- Signals to be measured for each current protection element: the threshold values, total tripping time (recommended), or alternatively tripping delays and the dropout ratios; each time 3 x single-phase and 1 x three-phase.

NOTICE

Eaton recommends measuring the total tripping time instead of the tripping delay. The tripping delay should be specified by the customer. The total tripping time is measured at the position signaling contact of the breaker (not at the relay output contacts!).

Total tripping time = tripping delay (please refer to the tolerances of the protection elements)
+ breaker operating time (about 50 ms)

Please take the breaker operating times from the technical data specified in the relevant documentation provided by the breaker manufacturer.

Necessary means:
- Current source;
- Current meters; and
- Timer.

Procedures:

Testing the threshold values (3 x single-phase and 1 x three-phase)
For each test performed, feed a current that is about 3-5% above the threshold value for activation/tripping. Then check the threshold values.

Testing the total tripping delay (recommendation)
Measure the total tripping times at the auxiliary contacts of the breaker (breaker tripping).

Testing the tripping delay (measuring at the relay output contact)
Measure the tripping times at the relay output contact.

Testing the dropout ratio
Reduce the current to 97% below the trip value and check the dropout ratio.

Successful test result
The measured total tripping delays or individual tripping delays, threshold values, and dropout ratios correspond with those values specified in the adjustment list. Permissible deviations/tolerances can be found under Technical Data.

51P - INV Overcurrent-Protection Module [ANSI 51P]

Elements
51P[1] ,51P[2] ,51P[3] ,51P[4]

WARNING **If you are using inrush blockings, the tripping delay of the current protection functions must be at least 30 ms or more in order to prevent faulty trippings.**

NOTICE **All overcurrent protective elements are identically structured.**

For each element, the following characteristics are available:

- NINV (IEC/XInv);
- VINV (IEC/XInv);
- LINV (IEC/XInv);
- EINV (IEC/XInv);
- MINV (ANSI/XInv);
- VINV (ANSI/XInv);
- EINV (ANSI/XInv);
- Thermal Flat;
- Therm Flat IT;
- Therm Flat I2T; and
- Therm Flat I4T.

Explanation:

t = Tripping delay

t-multiplier = Time multiplier/tripping characteristic factor

I = Fault current

Pickup = If the pickup value is exceeded, the module/element starts to time out to trip.

IEC NINV

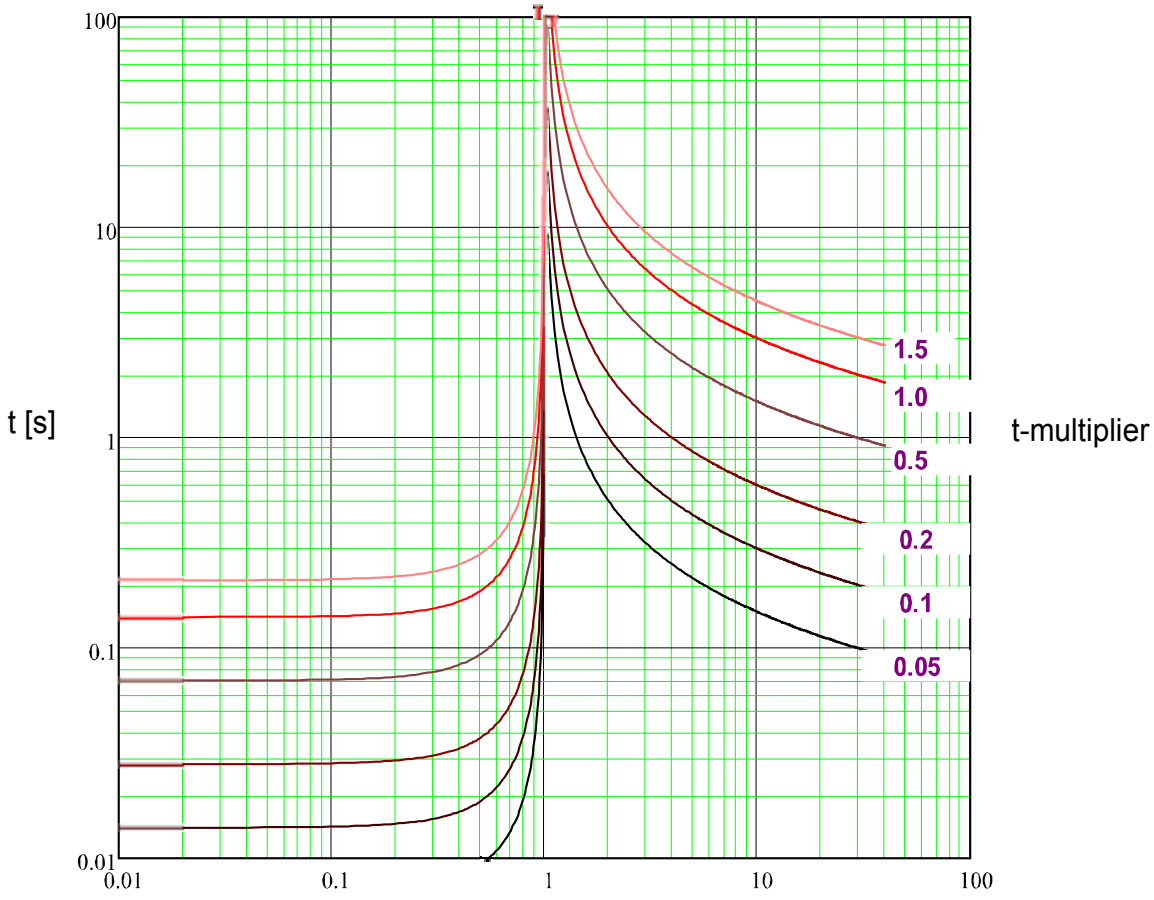
Notice!
Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

Reset

$$t = \left| \frac{0.14}{\left(\frac{I}{I_{Pickup}}\right)^{2} - 1} \right| * \text{t-multiplier [s]}$$

Trip

$$t = \frac{0.14}{\left(\frac{I}{I_{Pickup}}\right)^{0.02} - 1} * \text{t-multiplier [s]}$$



IEC VINV

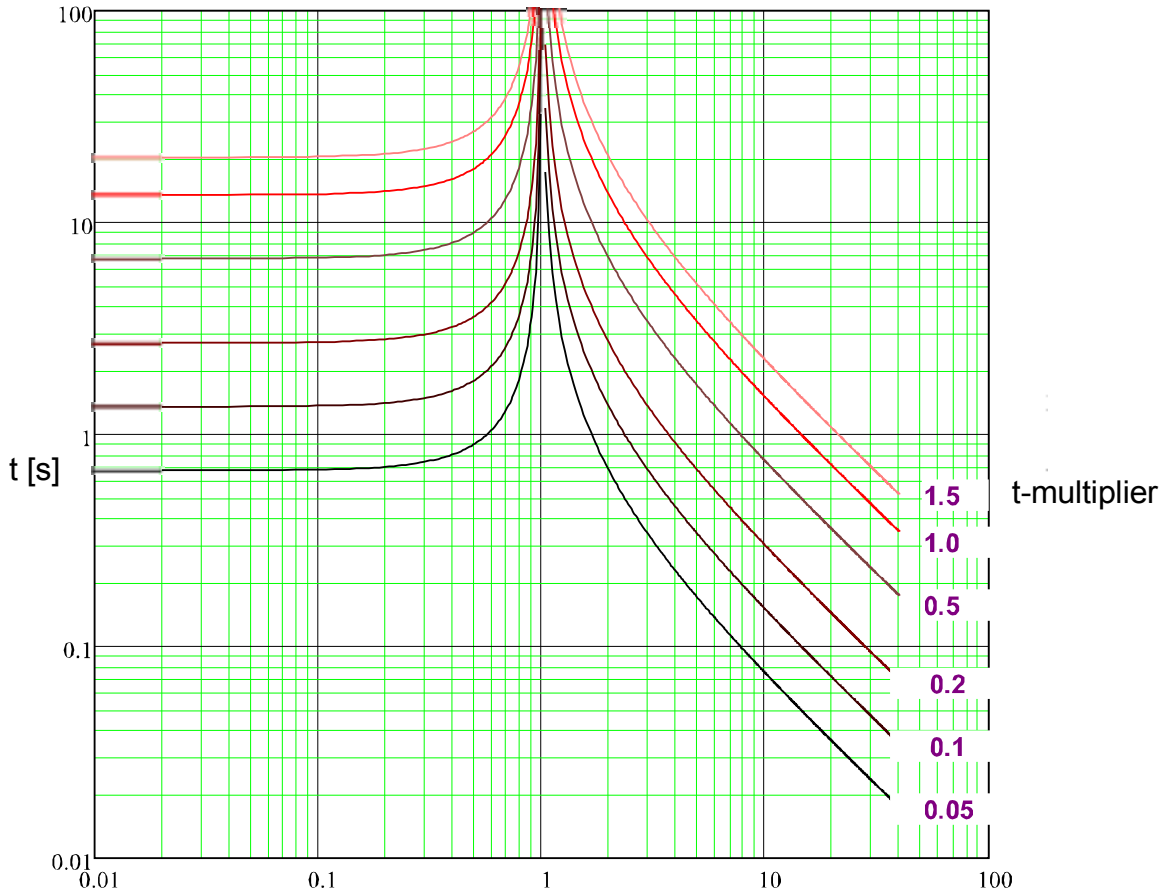
Notice!
Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

Reset

$$t = \left| \frac{13.5}{\left(\frac{I}{Pickup}\right)^{2}-1} \right| \text{*t-multiplier [s]}$$

Trip

$$t = \frac{13.5}{\left(\frac{I}{Pickup}\right)-1} \text{*t-multiplier [s]}$$



IEC LINV

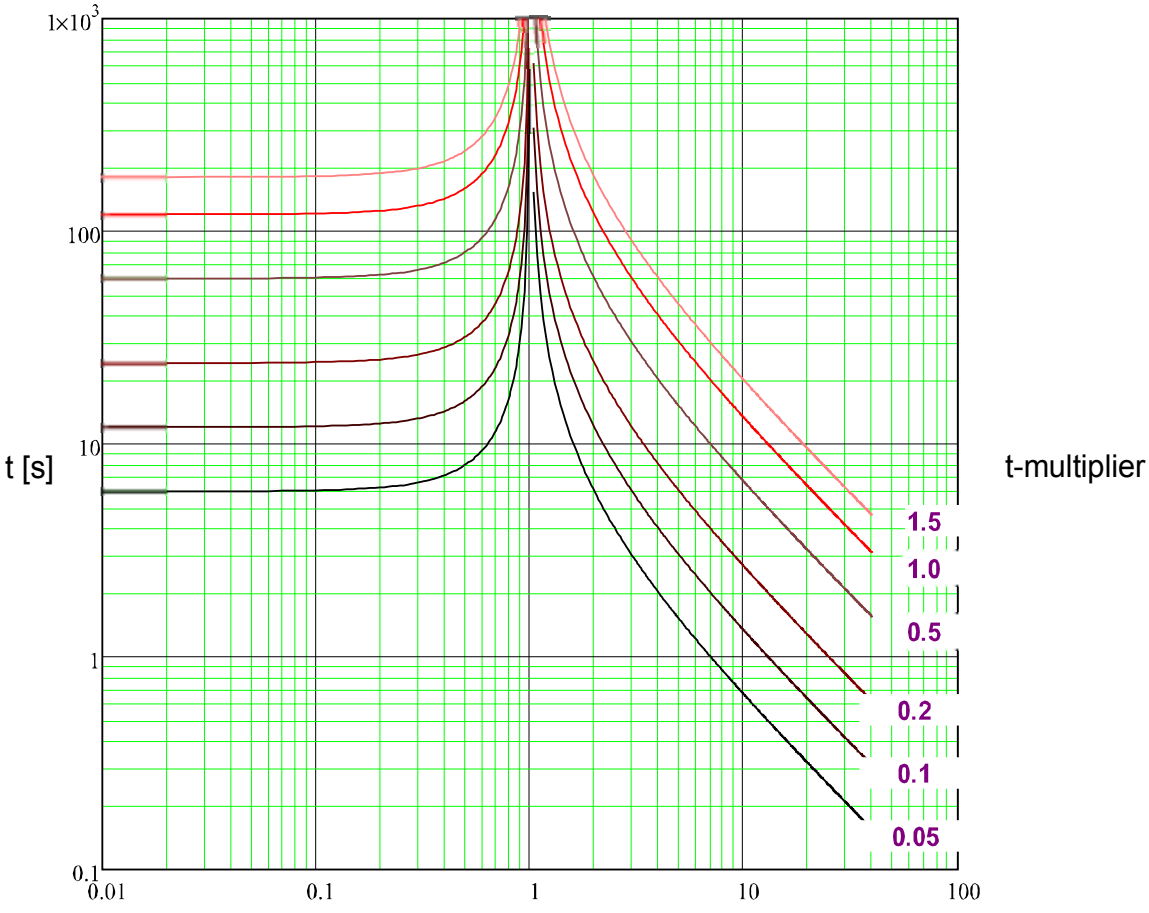
Notice!
Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

Reset

$$t = \left| \frac{120}{\left(\frac{I}{Pickup}\right)^{2}-1} \right| * \text{t-multiplier [s]}$$

Trip

$$t = \frac{120}{\left(\frac{I}{Pickup}\right)-1} * \text{t-multiplier [s]}$$



x * Pickup (Multiples of Pickup)

IEC EINV

Notice!

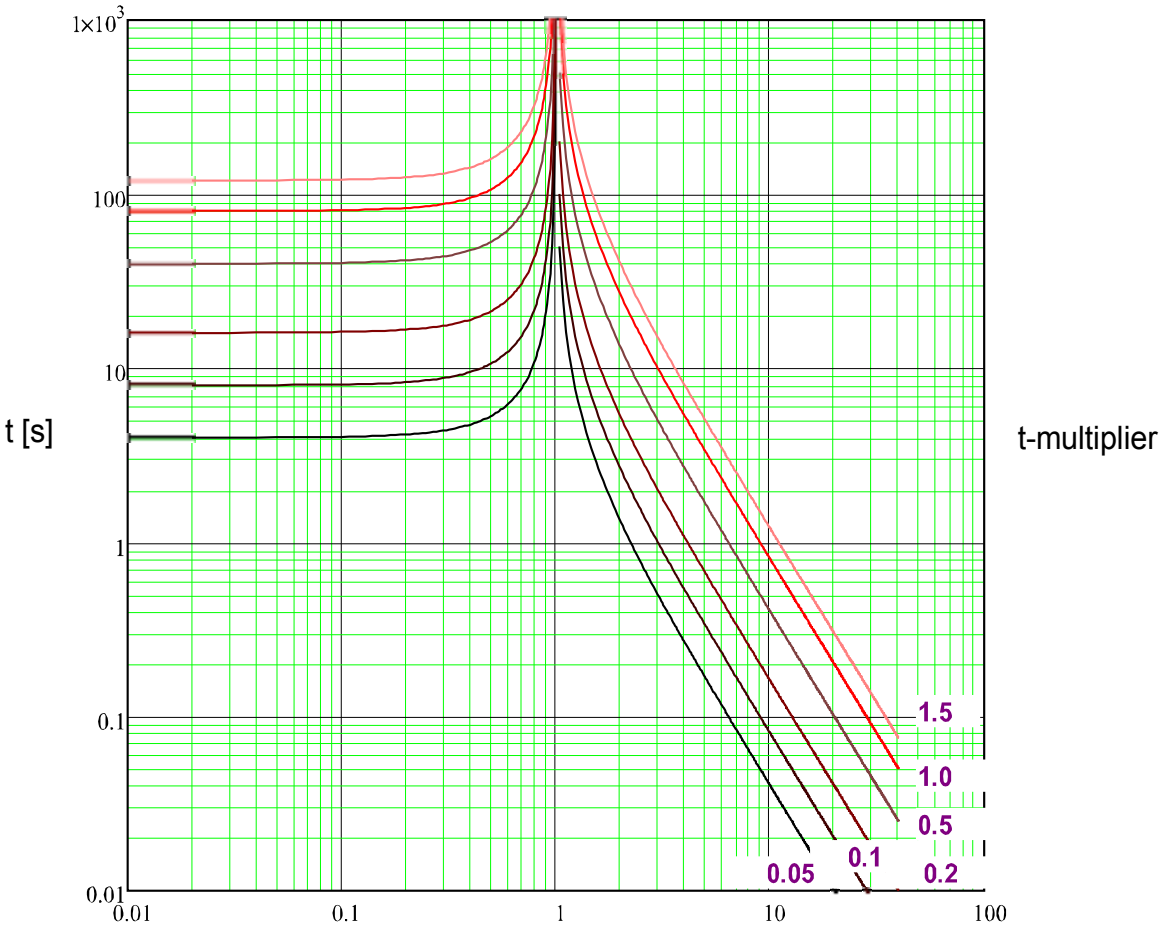
Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

Reset

$$t = \left| \frac{80}{\left(\frac{I}{Pickup}\right)^2 - 1} \right| * \text{t-multiplier [s]}$$

Trip

$$t = \frac{80}{\left(\frac{I}{Pickup}\right)^2 - 1} * \text{t-multiplier [s]}$$



ANSI MINV

Notice!

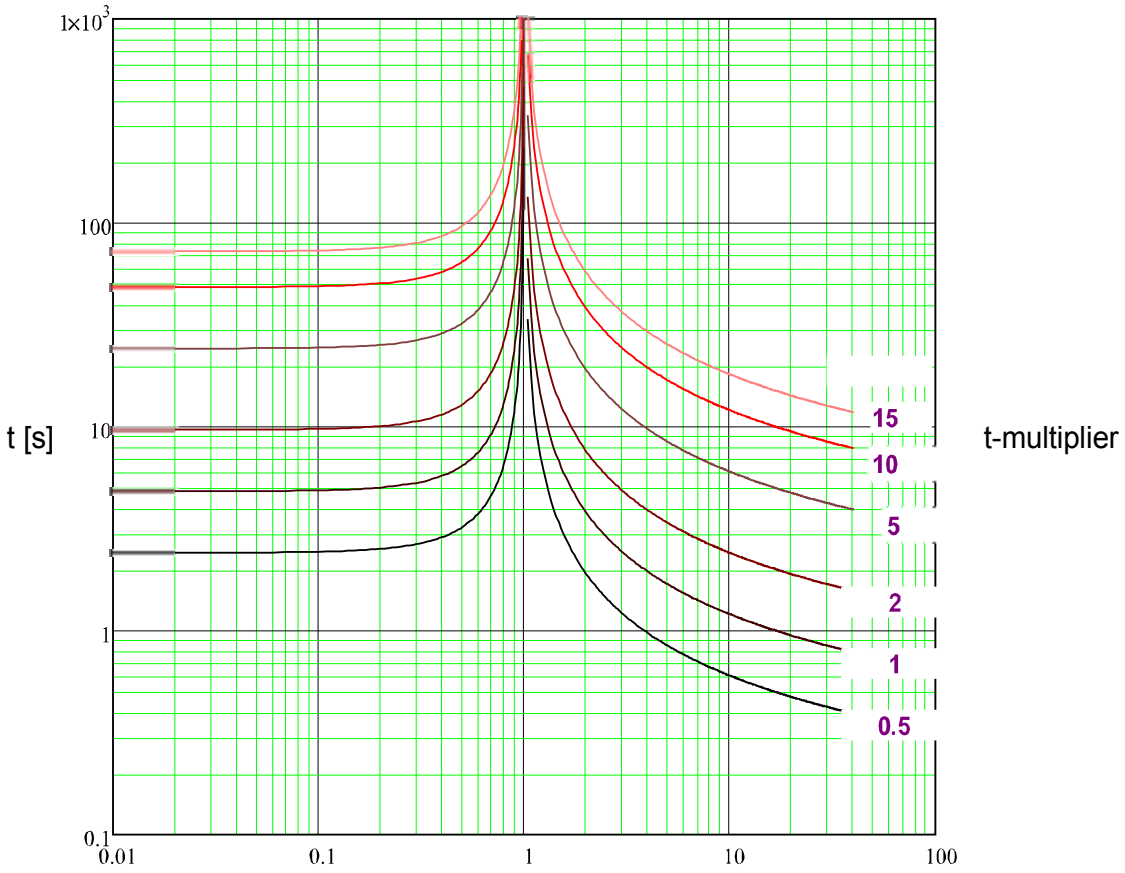
Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

Reset

$$t = \left| \frac{4.85}{\left(\frac{I}{Pickup}\right)^2 - 1} \right| \text{*t-multiplier [s]}$$

Trip

$$t = \left(\frac{0.0515}{\left(\frac{I}{Pickup}\right)^{0.02} - 1} + 0.1140 \right) \text{*t-multiplier [s]}$$



ANSI VINV

Notice!

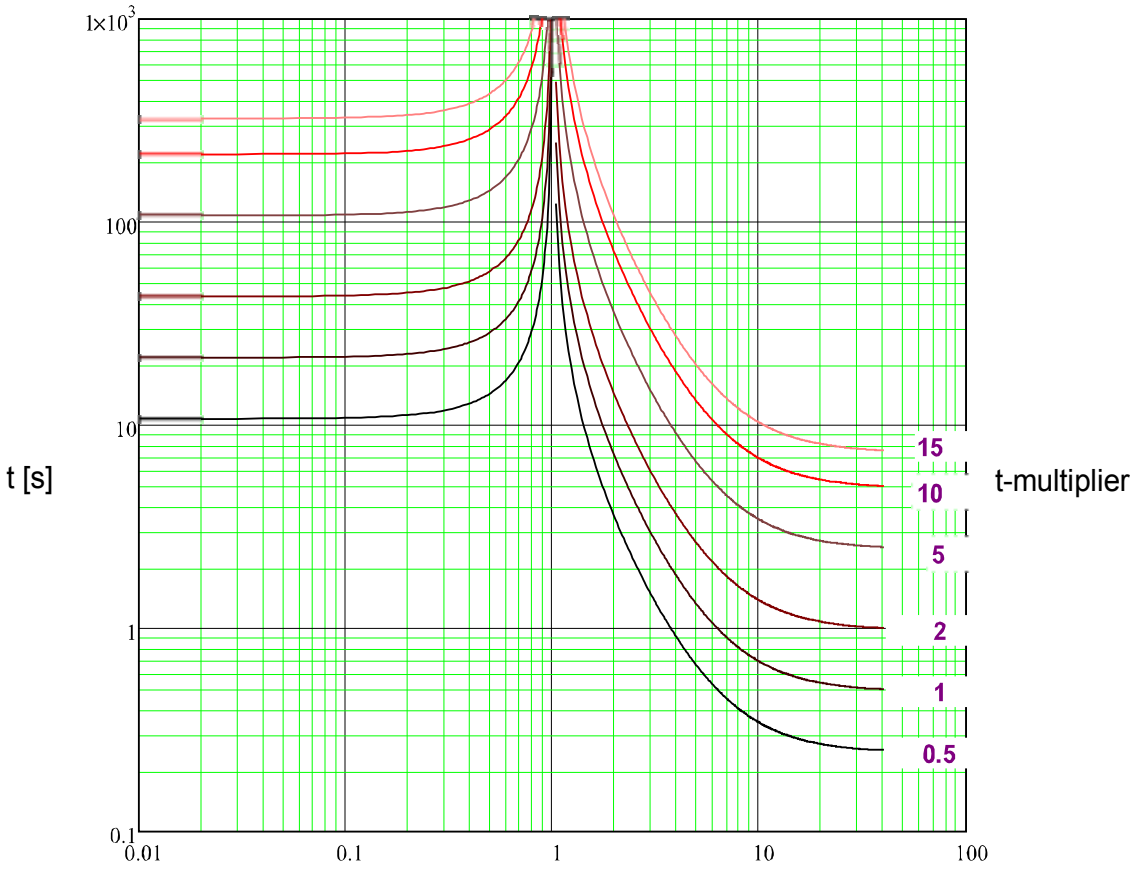
Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

Reset

$$t = \left| \frac{21.6}{\left(\frac{I}{Pickup}\right)^2 - 1} \right| * \text{t-multiplier [s]}$$

Trip

$$t = \left(\frac{19.61}{\left(\frac{I}{Pickup}\right)^2 - 1} + 0.491 \right) * \text{t-multiplier [s]}$$



x * Pickup (Multiples of Pickup)

ANSI EINV

Notice!

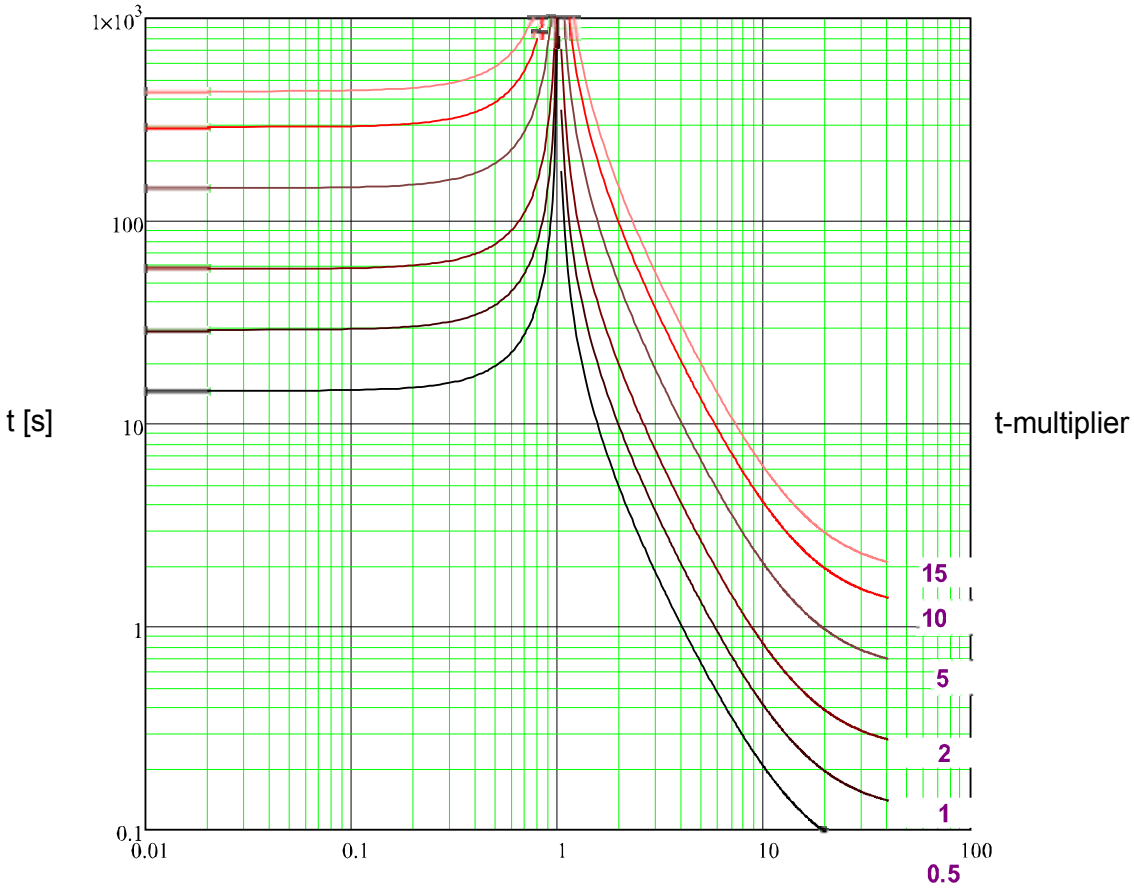
Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

Reset

$$t = \left| \frac{29.1}{\left(\frac{I}{Pickup}\right)^2 - 1} \right| * \text{t-multiplier [s]}$$

Trip

$$t = \left(\frac{28.2}{\left(\frac{I}{Pickup}\right)^2 - 1} + 0.1217 \right) * \text{t-multiplier [s]}$$



x * Pickup (Multiples of Pickup)

Therm Flat

Notice!

Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

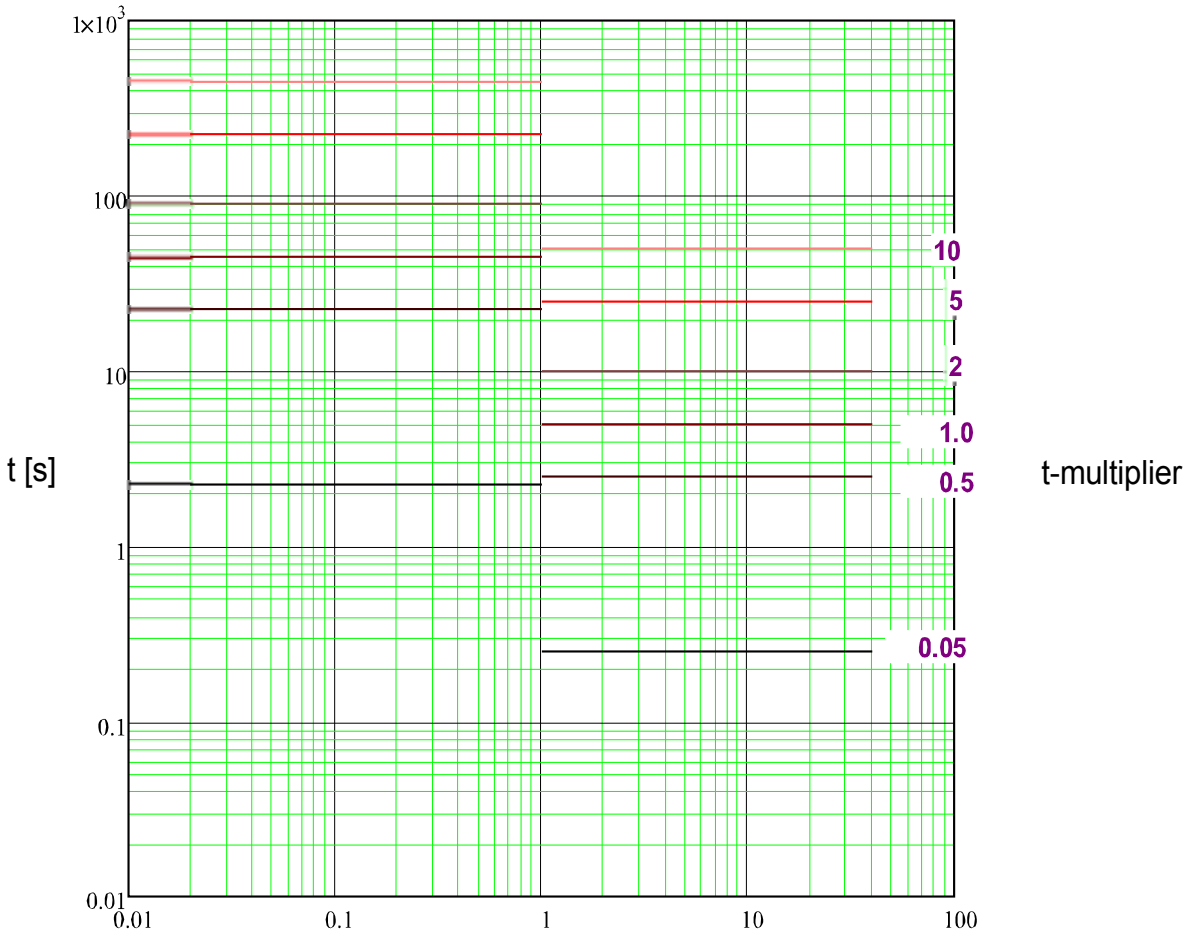
Reset

$$t = \left| \frac{5*3^2}{\left(\frac{I}{In}\right)^0} \right| *\text{t-multiplier [s]}$$

Trip

$$t = \frac{5*1^2}{\left(\frac{I}{In}\right)^0} *\text{t-multiplier [s]}$$

$$t = 45 *\text{t-multiplier [s]}$$



x * In (Multiples of the Nominal Current)

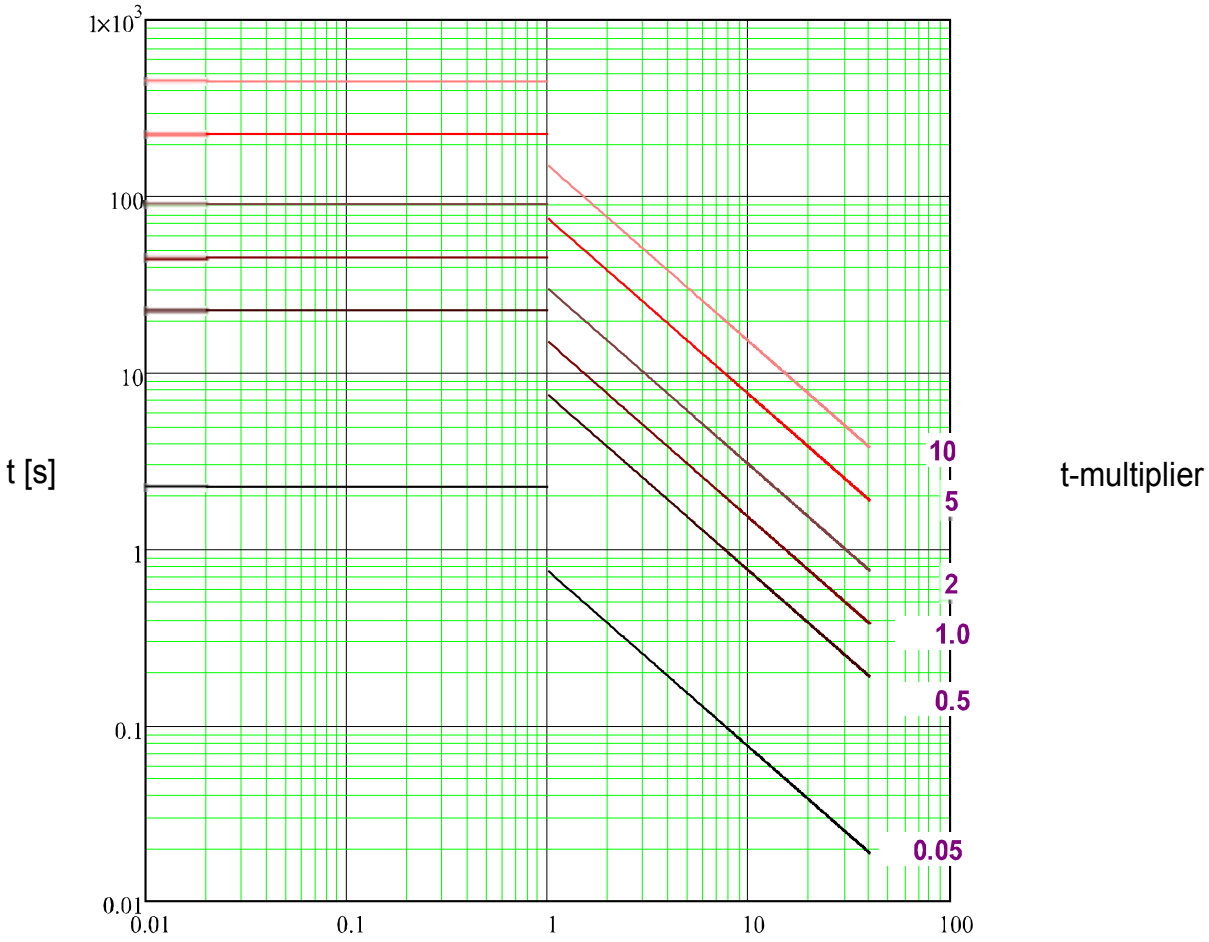
IT

Notice!

Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

Reset **Trip**

$$t = \left| \frac{5*3^{2}}{\left(\frac{I}{In}\right)^{0}} \right| *\text{t-multiplier [s]} \qquad t = \frac{5*3^{1}}{\left(\frac{I}{In}\right)^{1}} *\text{t-multiplier [s]}$$



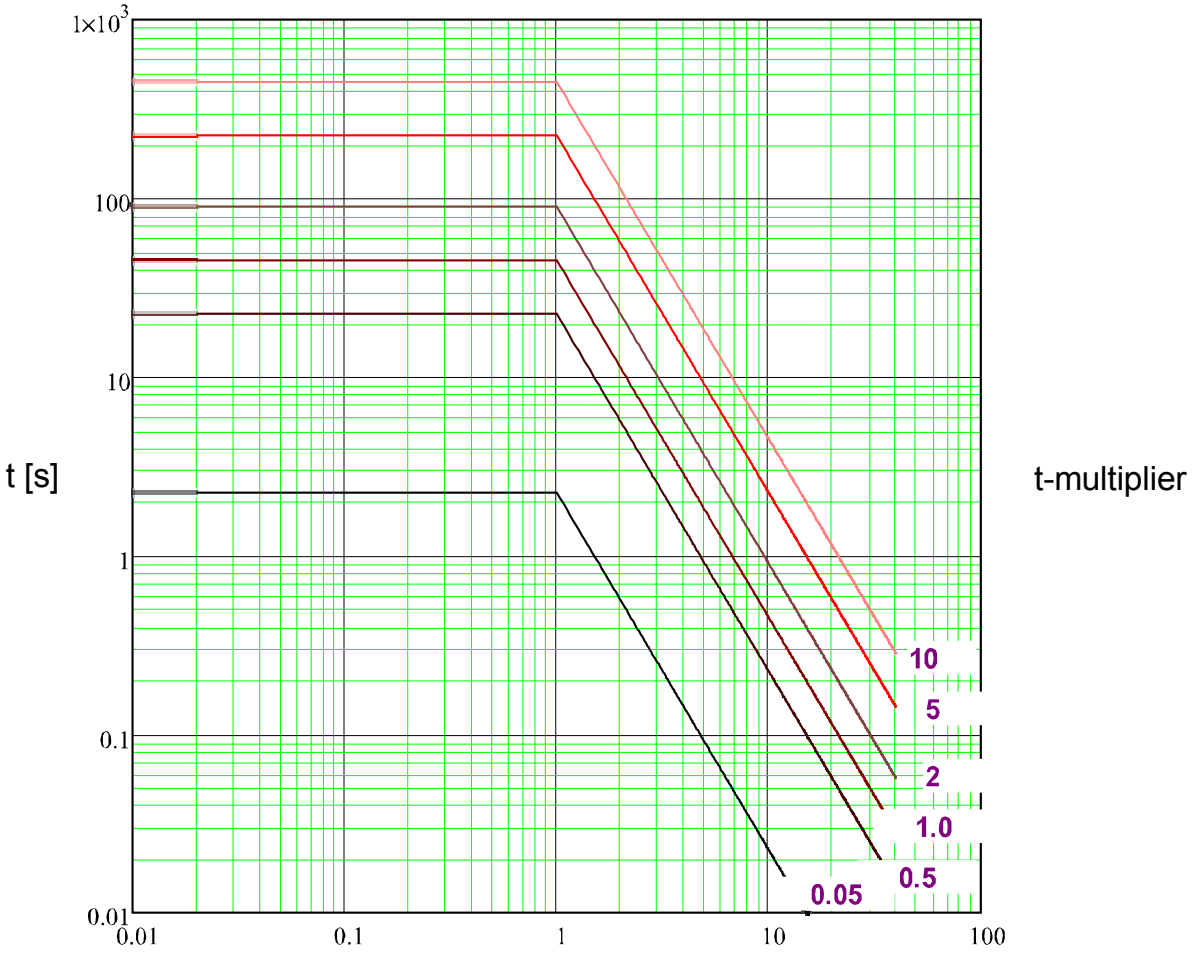
I2T

Notice!

Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

Reset **Trip**

$$t = \left| \frac{5*3^2}{\left(\frac{I}{In}\right)^0} \right| *\text{t-multiplier [s]} \qquad t = \frac{5*3^2}{\left(\frac{I}{In}\right)^2} *\text{t-multiplier [s]}$$



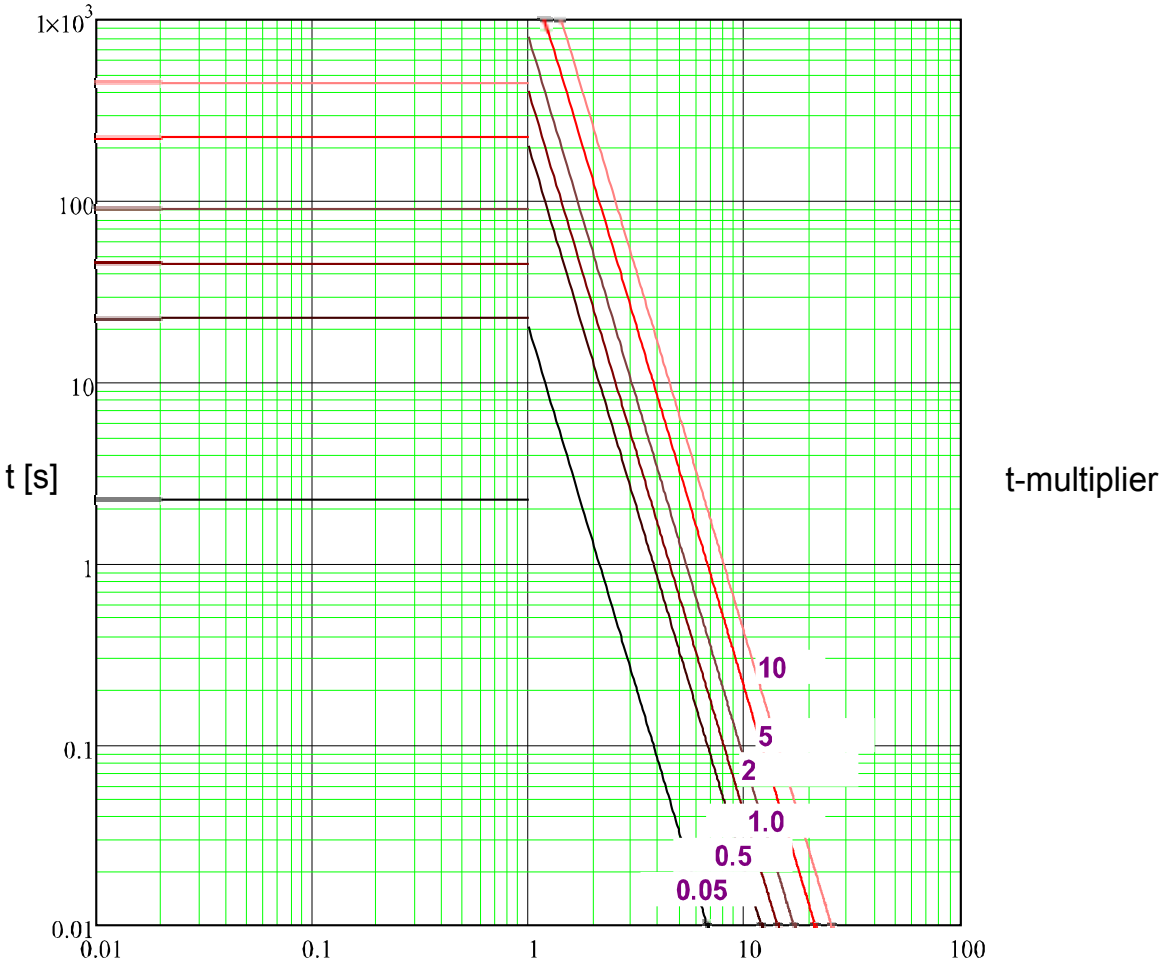
I4T

Notice!

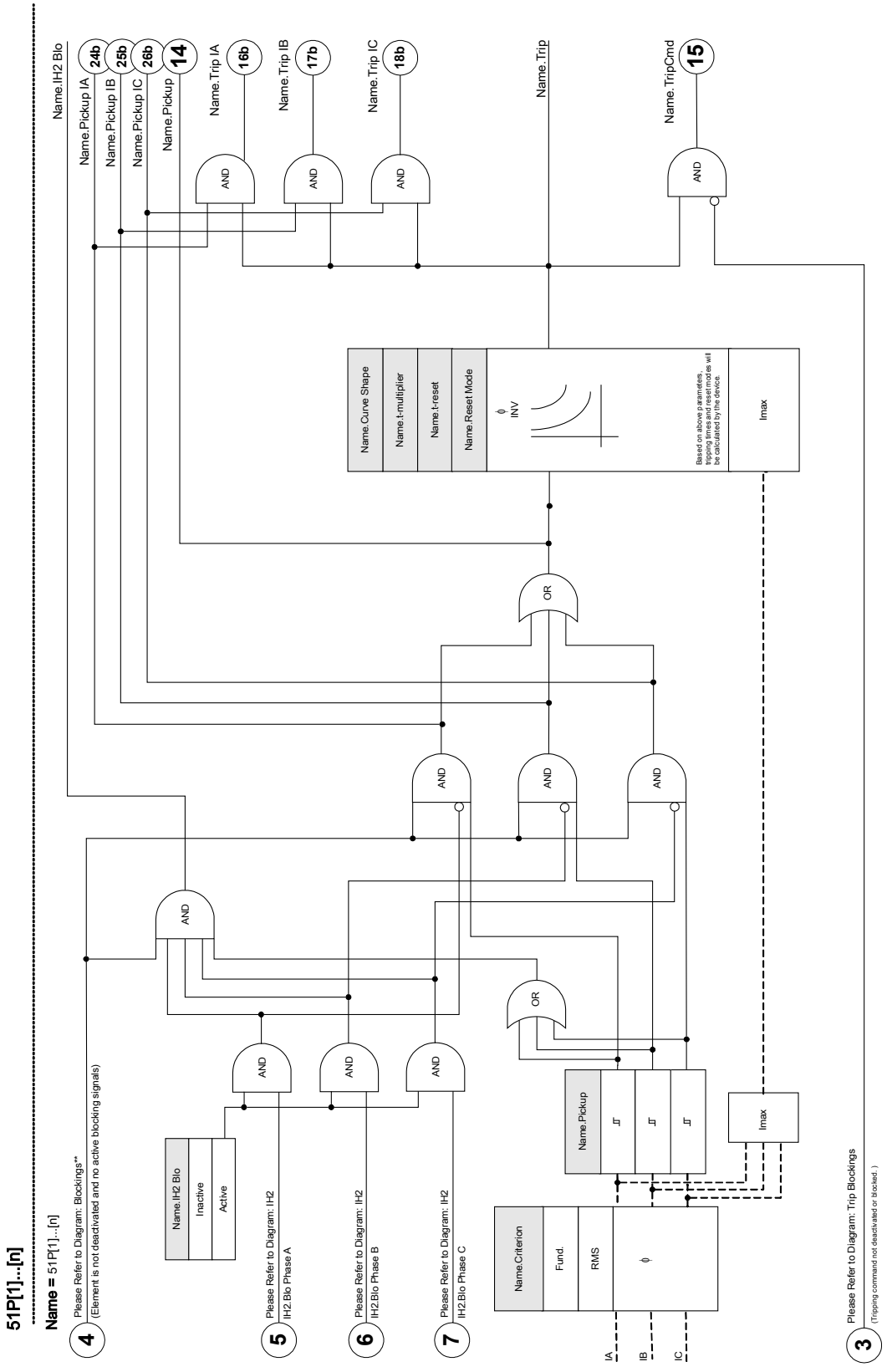
Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

Reset **Trip**

$$t = \left| \frac{5*3^{2}}{\left(\frac{I}{In}\right)^{0}} \right| *\text{t-multiplier [s]} \qquad t = \frac{5*3^{4}}{\left(\frac{I}{In}\right)^{4}} *\text{t-multiplier [s]}$$



x *In (Multiples of the Nominal Current)


51P[1]...[n]
Name = 51P[1]...[n]
Name.IH2 Blo
Name.Pickup IA
Name.Pickup IB
Name.Pickup IC
Name.Pickup
Name.Trip IA
Name.Trip IB
Name.Trip IC
Name.Trip
Name.TripCmd
24b
25b
26b
14
16b
17b
18b
15
AND
OR
Name.Curve Shape
Name.t-multiplier
Name.t-reset
Name.Reset Mode
INV
Based on above parameters, tripping times and reset modes will be calculated by the device.
Imax
Name.IH2 Blo
Inactive
Active
Name.Pickup
Name.Criterion
Fund.
RMS
IA
IB
IC
4
Please Refer to Diagram: Blockings**
(Element is not deactivated and no active blocking signals)
5
Please Refer to Diagram: IH2
IH2.Blo Phase A
6
Please Refer to Diagram: IH2
IH2.Blo Phase B
7
Please Refer to Diagram: IH2
IH2.Blo Phase C
3
Please Refer to Diagram: Trip Blockings
(Tripping command not deactivated or blocked.)

Device Planning Parameters of the 51P Module

Parameter	*Description*	*Options*	*Default*	*Menu Path*
Mode	Mode	51P[1]: Non-directional 51P[2]: Do not use, Non-directional 51P[3]: Non-directional 51P[4]: Do not use, Non-directional	Non-directional	[Device Planning]

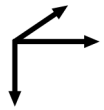
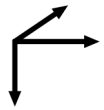
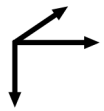
Global Protection Parameters of the 51P Module

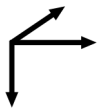
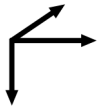
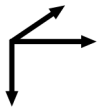
Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Winding Side	Winding Side	W1, W2	51P[1]: W1 51P[2]: W1 51P[3]: W2 51P[4]: W2	[Protection Para /Global Prot Para /I-Prot /51P[1]]
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /51P[1]]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /51P[1]]
ExBlo TripCmd	External blocking of the Trip Command of the module/the element, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /51P[1]]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Rvs Blo	Reverse Blocking, if Reverse Blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /51P[1]]
AdaptSet 1	Assignment Adaptive Parameter 1	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /51P[1]]
AdaptSet 2	Assignment Adaptive Parameter 2	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /51P[1]]
AdaptSet 3	Assignment Adaptive Parameter 3	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /51P[1]]
AdaptSet 4	Assignment Adaptive Parameter 4	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /51P[1]]

Setting Group Parameters of the 51P Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Function	Permanent activation or deactivation of module/element.	Inactive, Active	51P[1]: Active 51P[2]: Inactive 51P[3]: Active 51P[4]: Inactive	[Protection Para /<n> /I-Prot /51P[1]]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /51P[1]]
Rvs Blo Fc	Activate (allow) or inactivate (disallow) reverse blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/element are blocked that are parameterized "Rvs Blo Fc = active".	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /51P[1]]
Blo TripCmd	Permanent blocking of the Trip Command of the module/element.	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /51P[1]]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
ExBlo TripCmd Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo TripCmd Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /51P[1]]
Criterion	Measuring method: fundamental or rms	Fundamental, True RMS	True RMS	[Protection Para /<n> /I-Prot /51P[1]]
Pickup 	If the pickup value is exceeded, the module/element starts to time out to trip.	0.01 - 40.00In	1.00In	[Protection Para /<n> /I-Prot /51P[1]]
Curve Shape 	Characteristic	IEC NINV, IEC VINV, IEC EINV, IEC LINV, ANSI MINV, ANSI VINV, ANSI EINV, Therm Flat, IT, I2T, I4T	ANSI MINV	[Protection Para /<n> /I-Prot /51P[1]]
t-multiplier 	Time multiplier/tripping characteristic factor	0.05 - 20.00	51P[1]: 1.0 51P[2]: 2.0 51P[3]: 1.0 51P[4]: 2.0	[Protection Para /<n> /I-Prot /51P[1]]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Reset Mode 	Reset Mode	Instantaneous, t-delay, Calculated	Calculated	[Protection Para /<n> /I-Prot /51P[1]]
t-reset 	Reset time for intermittent phase failures (INV characteristics only) Available if:Reset Mode = t-delay	0.00 - 60.00s	0s	[Protection Para /<n> /I-Prot /51P[1]]
IH2 Blo 	Blocking the trip command, if an inrush is detected.	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /51P[1]]

51P Module Input States

Name	*Description*	*Assignment Via*
ExBlo1-I	Module Input State: External Blocking1	[Protection Para /Global Prot Para /I-Prot /51P[1]]
ExBlo2-I	Module Input State: External Blocking2	[Protection Para /Global Prot Para /I-Prot /51P[1]]
ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command	[Protection Para /Global Prot Para /I-Prot /51P[1]]
Rvs Blo-I	Module Input State: Reverse Blocking	[Protection Para /Global Prot Para /I-Prot /51P[1]]
AdaptSet1-I	Module Input State: Adaptive Parameter1	[Protection Para /Global Prot Para /I-Prot /51P[1]]
AdaptSet2-I	Module Input State: Adaptive Parameter2	[Protection Para /Global Prot Para /I-Prot /51P[1]]
AdaptSet3-I	Module Input State: Adaptive Parameter3	[Protection Para /Global Prot Para /I-Prot /51P[1]]
AdaptSet4-I	Module Input State: Adaptive Parameter4	[Protection Para /Global Prot Para /I-Prot /51P[1]]

51P Module Signals (Output States)

Name	*Description*
Active	Signal: Active
ExBlo	Signal: External Blocking
Rvs Blo	Signal: Reverse Blocking
Blo TripCmd	Signal: Trip Command blocked
ExBlo TripCmd	Signal: External Blocking of the Trip Command
IH2 Blo	Signal: Blocking the trip command by IH2
Pickup IA	Signal: Pickup IA
Pickup IB	Signal: Pickup IB
Pickup IC	Signal: Pickup IC
Pickup	Signal: Pickup
Trip IA	Signal: Trip IA
Trip IB	Signal: Trip IB
Trip IC	Signal: Trip IC
Trip	Signal: Trip
TripCmd	Signal: Trip Command
Active AdaptSet	Active Adaptive Parameter
DefaultSet	Signal: Default Parameter Set
AdaptSet 1	Signal: Adaptive Parameter 1
AdaptSet 2	Signal: Adaptive Parameter 2
AdaptSet 3	Signal: Adaptive Parameter 3
AdaptSet 4	Signal: Adaptive Parameter 4

Commissioning: Overcurrent Protection, Non-directional [ANSI 51P]

Object to be tested

- Signals to be measured for each current protection element: the threshold values, total tripping time (recommended), or alternatively tripping delays and the dropout ratios; each time 3 x single-phase and 1 x three-phase.

NOTICE

Eaton recommends measuring the total tripping time instead of the tripping delay. The tripping delay should be specified by the customer. The total tripping time is measured at the position signaling contact of the breaker (not at the relay output contacts!).

Total tripping time = tripping delay (please refer to the tolerances of the protection stages)
+ breaker operating time (about 50 ms)

Please take the breaker operating times from the technical data specified in the relevant documentation provided by the breaker manufacturer.

Necessary means:
- Current source;
- Current meters; and
- Timer.

Procedure:

Testing the threshold values (3 x single-phase and 1 x three-phase)
For each test performed, feed a current that is about 3-5% above the threshold value for activation/tripping. Then check the threshold values.

Testing the total tripping delay (recommendation)
Measure the total tripping times at the auxiliary contacts of the breakers (breaker tripping).

Testing the tripping delay (measuring at the relay output contact)
Measure the tripping times at the relay output contact.

Testing the dropout ratio
Reduce the current to 97% below the trip value and check the dropout ratio.

Successful test result
The measured total tripping delays or individual tripping delays, threshold values, and dropout ratios correspond with those values specified in the adjustment list. Permissible deviations/tolerances can be found under Technical Data.

50X DEFT Measured Ground Fault Protection Module – [ANSI 50X]

Elements
50X[1] ,50X[2]

WARNING **If you are using inrush blockings, the tripping delay of the ground current protection functions must be at least 30 ms or more in order to prevent faulty trippings.**

NOTICE **All ground current elements are identically structured.**

For each element the following characteristics are available:

- DEFT (definite time).

Explanation:

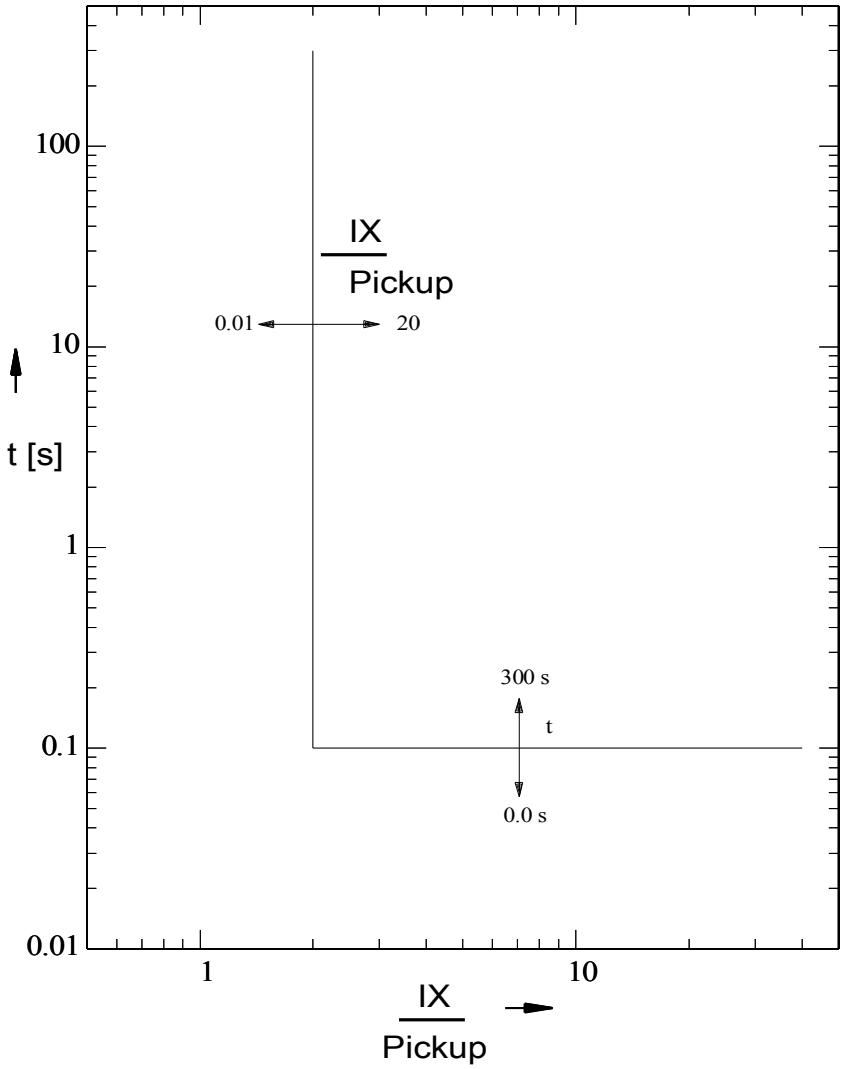
t = Tripping delay

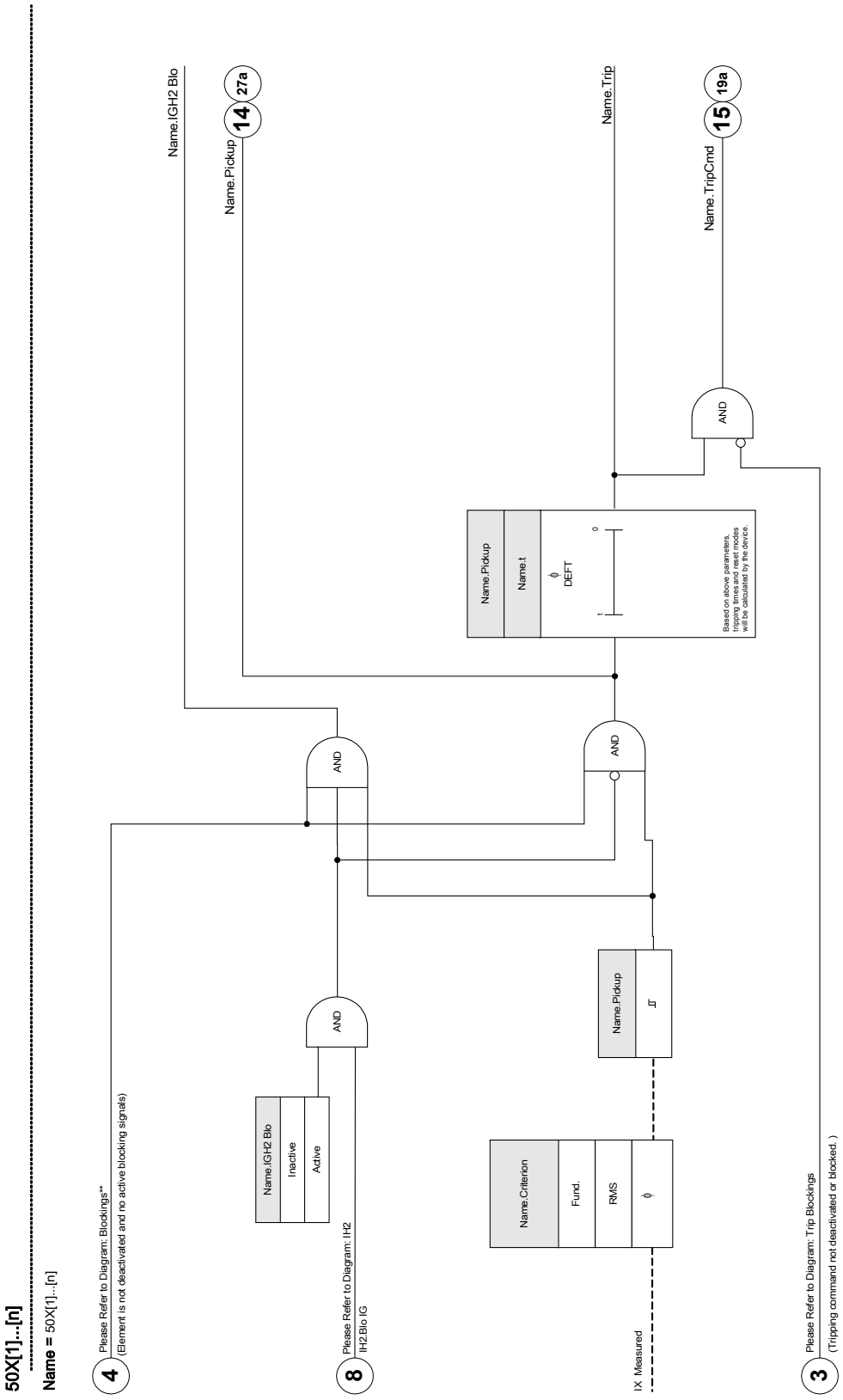
IX = Fault current

Pickup = If the pickup value is exceeded, the module/element starts to time out to trip.

The ground current can be measured either directly via a zero sequence transformer or detected by a residual connection. The ground current can alternatively be calculated from the phase currents; but this is only possible if the current transformers are Wye-connected.

DEFT




50X[1]...[n]
Name = 50X[1]...[n]
4
Please Refer to Diagram: Blockings**
(Element is not deactivated and no active blocking signals)
8
Please Refer to Diagram: IH2
IH2.Blo IG
IX Measured
3
Please Refer to Diagram: Trip Blockings
(Tripping command not deactivated or blocked.)
Name.IGH2 Blo
Name.Pickup
14
27a
Name.Trip
Name.TripCmd
15
19a
AND
AND
AND
Name.IGH2 Blo
Inactive
Active
Name.Criterion
Fund.
RMS
Name.Pickup
Name.Pickup
Name.t
DEFT
Based on above parameters, tripping times and reset modes will be calculated by the device.

Device Planning Parameters of the 50X Ground Fault Protection

Parameter	*Description*	*Options*	*Default*	*Menu Path*
Mode	Mode	Non-directional	Non-directional	[Device Planning]

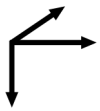
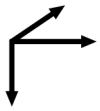
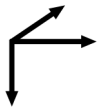
Global Protection Parameters of the 50X Ground Fault Protection

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Winding Side	Winding Side	W1, W2	50X[1]: W1 50X[2]: W2	[Protection Para /Global Prot Para /I-Prot /50X[1]]
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /50X[1]]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /50X[1]]
ExBlo TripCmd	External blocking of the Trip Command of the module/the element, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /50X[1]]
Rvs Blo	Reverse Blocking, if Reverse Blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /50X[1]]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
AdaptSet 1	Assignment Adaptive Parameter 1	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /50X[1]]
AdaptSet 2	Assignment Adaptive Parameter 2	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /50X[1]]
AdaptSet 3	Assignment Adaptive Parameter 3	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /50X[1]]
AdaptSet 4	Assignment Adaptive Parameter 4	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /50X[1]]

Setting Group Parameters of the 50X Ground Fault Protection

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Function	Permanent activation or deactivation of module/element.	Inactive, Active	50X[1]: Inactive 50X[2]: Active	[Protection Para /<n> /I-Prot /50X[1]]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /50X[1]]
Rvs Blo Fc	Activate (allow) or inactivate (disallow) reverse blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/element are blocked that are parameterized "Rvs Blo Fc = active".	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /50X[1]]
Blo TripCmd	Permanent blocking of the Trip Command of the module/element.	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /50X[1]]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
ExBlo TripCmd Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo TripCmd Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /50X[1]]
Criterion	Measuring method: fundamental or rms	Fundamental, True RMS	True RMS	[Protection Para /<n> /I-Prot /50X[1]]
Pickup 	If the pickup value is exceeded, the module/element will be started. Only available if: Characteristic = DEFT Or Characteristic = INV	0.01 - 20.00In	50X[1]: 1In 50X[2]: 1.0In	[Protection Para /<n> /I-Prot /50X[1]]
t 	Tripping delay Only available if: Characteristic = DEFT	0.00 - 300.00s	0.5s	[Protection Para /<n> /I-Prot /50X[1]]
IH2 Blo 	Blocking the trip command, if an inrush is detected.	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /50X[1]]

50X Ground Fault Protection Input States

Name	*Description*	*Assignment Via*
ExBlo1-I	Module Input State: External Blocking1	[Protection Para /Global Prot Para /I-Prot /50X[1]]
ExBlo2-I	Module Input State: External Blocking2	[Protection Para /Global Prot Para /I-Prot /50X[1]]
ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command	[Protection Para /Global Prot Para /I-Prot /50X[1]]
Rvs Blo-I	Module Input State: Reverse Blocking	[Protection Para /Global Prot Para /I-Prot /50X[1]]
AdaptSet1-I	Module Input State: Adaptive Parameter1	[Protection Para /Global Prot Para /I-Prot /50X[1]]
AdaptSet2-I	Module Input State: Adaptive Parameter2	[Protection Para /Global Prot Para /I-Prot /50X[1]]
AdaptSet3-I	Module Input State: Adaptive Parameter3	[Protection Para /Global Prot Para /I-Prot /50X[1]]
AdaptSet4-I	Module Input State: Adaptive Parameter4	[Protection Para /Global Prot Para /I-Prot /50X[1]]

50X Ground Fault Protection Signals (Output States)

Name	*Description*
Active	Signal: Active
ExBlo	Signal: External Blocking
Rvs Blo	Signal: Reverse Blocking
Blo TripCmd	Signal: Trip Command blocked
ExBlo TripCmd	Signal: External Blocking of the Trip Command
Pickup	Signal: Pickup IX or IR
Trip	Signal: Trip
TripCmd	Signal: Trip Command
IGH2 Blo	Signal: Blocked by IH2
Active AdaptSet	Active Adaptive Parameter
DefaultSet	Signal: Default Parameter Set
AdaptSet 1	Signal: Adaptive Parameter 1
AdaptSet 2	Signal: Adaptive Parameter 2
AdaptSet 3	Signal: Adaptive Parameter 3
AdaptSet 4	Signal: Adaptive Parameter 4

Commissioning: Ground Fault Protection – Non-directional [ANSI 50X]

Please test the non-directional ground overcurrent analog to the non-directional phase overcurrent protection.

51X INV Measured Ground Fault Protection Module [ANSI 51X]

Elements
51X[1] ,51X[2]

NOTICE **All ground current elements are identically structured.**

For each element the following characteristics are available:

- NINV (IEC/XInv);
- VINV (IEC/XInv);
- LINV (IEC/XInv);
- EINV (IEC/XInv);
- MINV (ANSI/XInv);
- VINV (ANSI/XInv);
- EINV (ANSI/XInv);
- Thermal Flat;
- Therm Flat IT;
- Therm Flat I2T; and
- Therm Flat I4T.

Explanation:

t = Tripping delay

t-multiplier = Time multiplier/tripping characteristic factor

IG = Fault current

Pickup = If the pickup value is exceeded, the module/element starts to time out to trip.

The ground current can be measured either directly via a zero sequence transformer or detected by a residual connection. The ground current can alternatively be calculated from the phase currents; but this is only possible if the current transformers are Wye-connected.

IEC NINV

Notice!

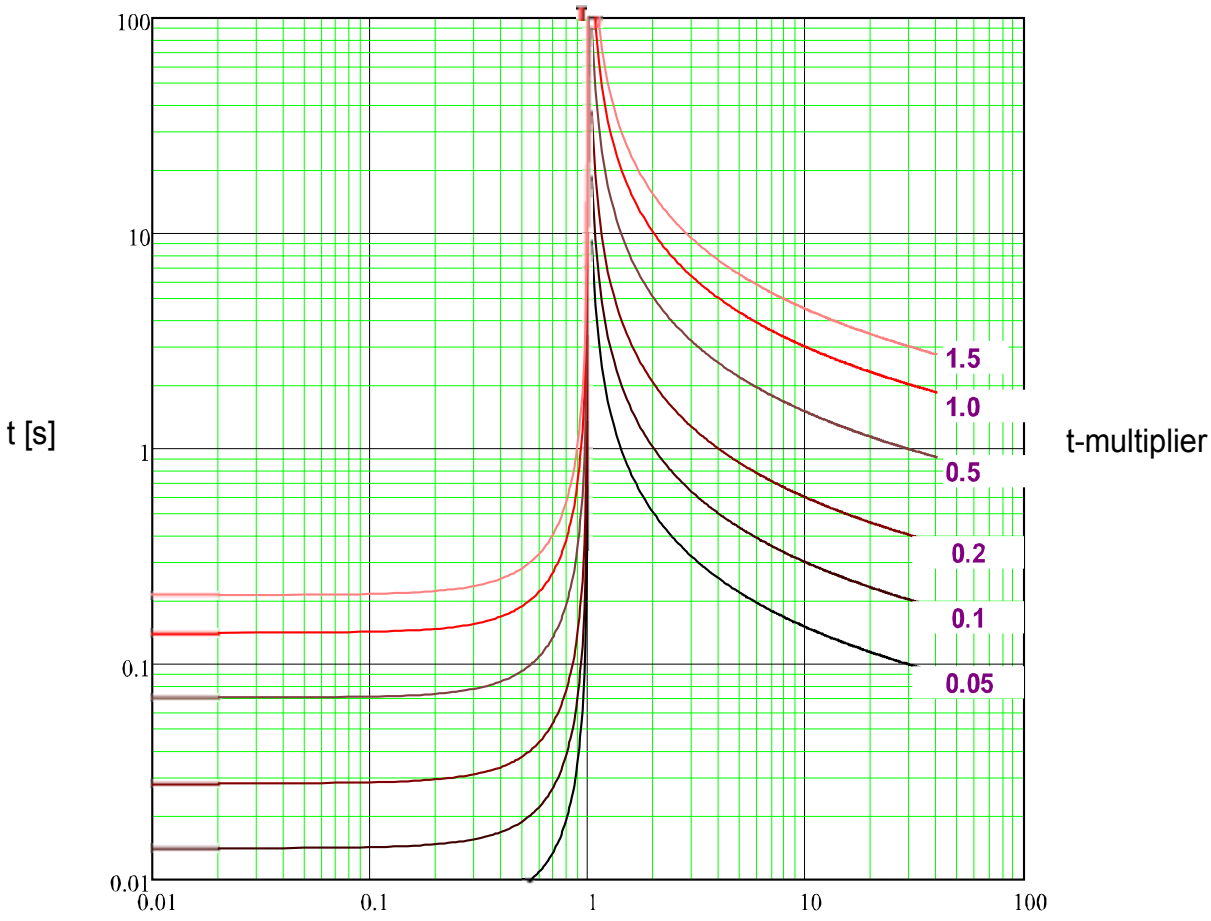
Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

Reset

$$t = \left| \frac{0.14}{\left(\frac{IG}{Pickup}\right)^{2} - 1} \right| * \text{t-multiplier [s]}$$

Trip

$$t = \frac{0.14}{\left(\frac{IG}{Pickup}\right)^{0.02} - 1} * \text{t-multiplier [s]}$$



IEC VINV

Notice!

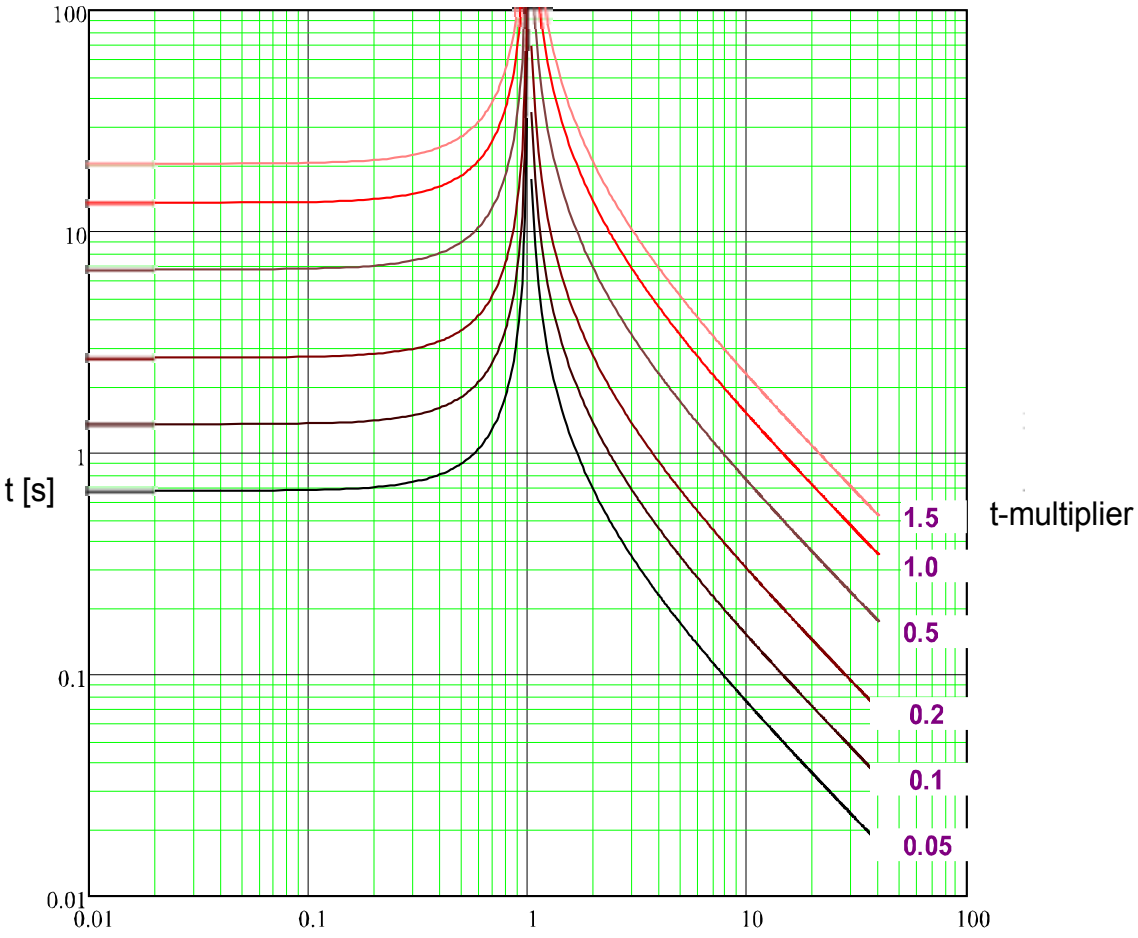
Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

Reset

$$t = \left| \frac{13.5}{\left(\frac{IG}{Pickup}\right)^2 - 1} \right| * \text{t-multiplier [s]}$$

Trip

$$t = \frac{13.5}{\left(\frac{IG}{Pickup}\right) - 1} * \text{t-multiplier [s]}$$



IEC LINV

Notice!

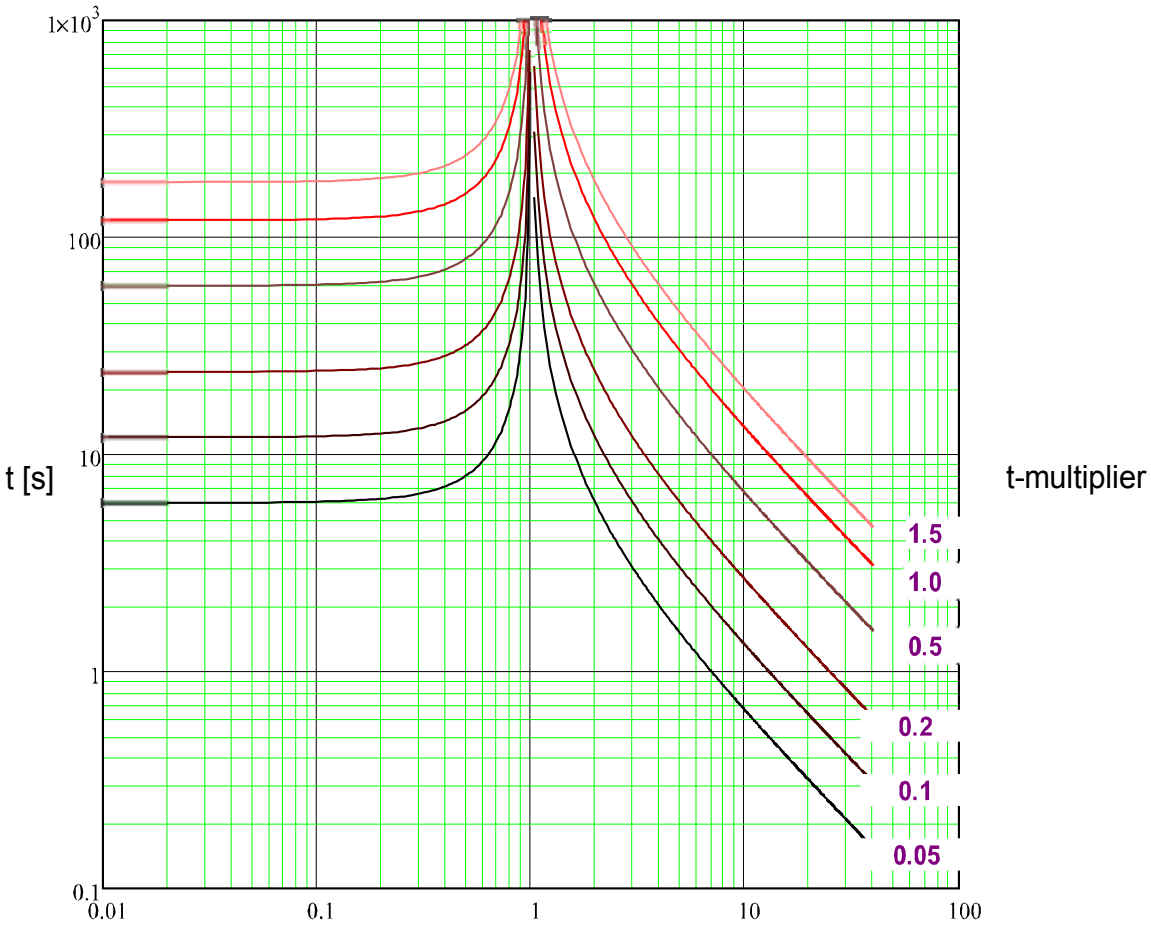
Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

Reset

$$t = \left| \frac{120}{\left(\frac{IG}{Pickup}\right)^2 - 1} \right| * \text{t-multiplier [s]}$$

Trip

$$t = \frac{120}{\left(\frac{IG}{Pickup}\right) - 1} * \text{t-multiplier [s]}$$



IEC EINV

Notice!

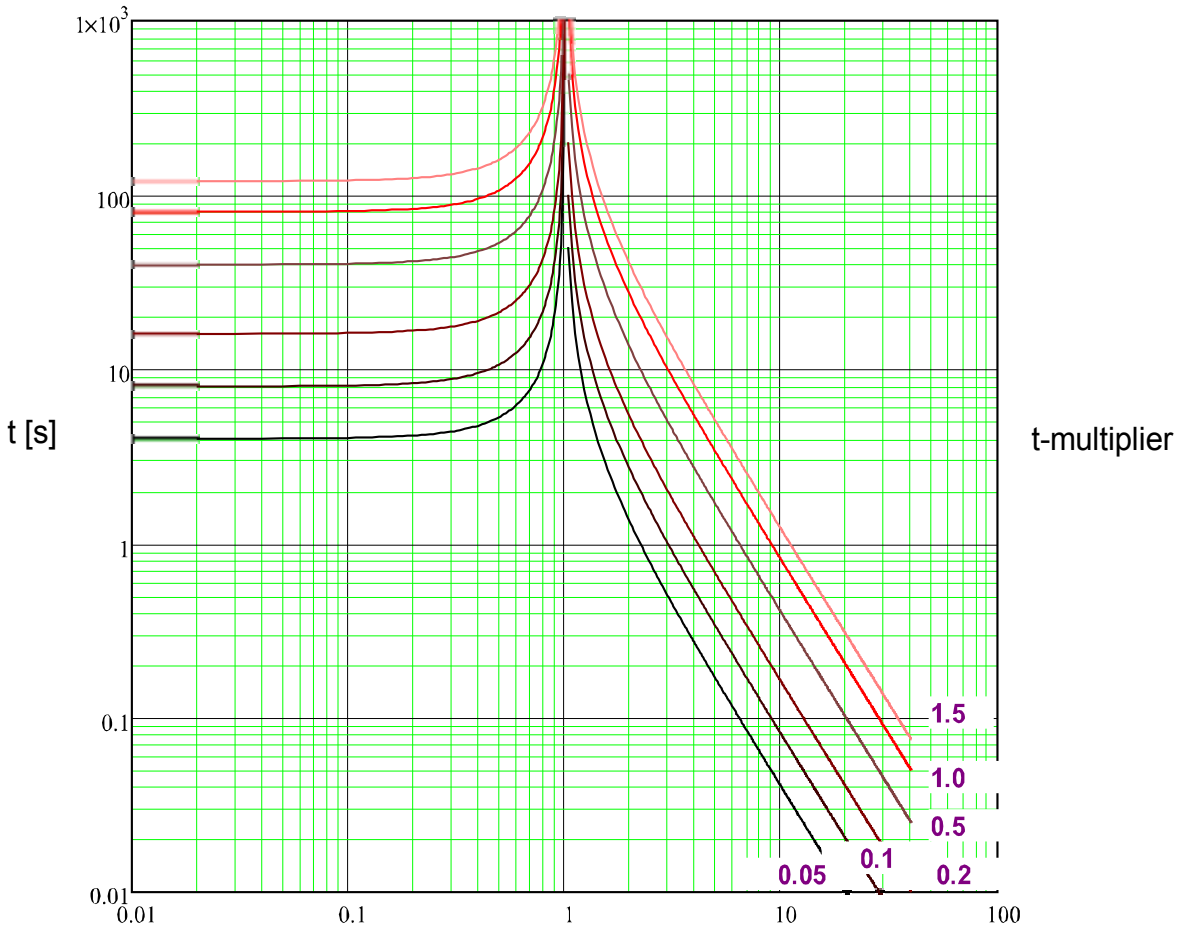
Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

Reset

$$t = \left| \frac{80}{\left(\frac{IG}{Pickup}\right)^2 - 1} \right| * \text{t-multiplier [s]}$$

Trip

$$t = \frac{80}{\left(\frac{IG}{Pickup}\right)^2 - 1} * \text{t-multiplier [s]}$$



ANSI MINV

Notice!

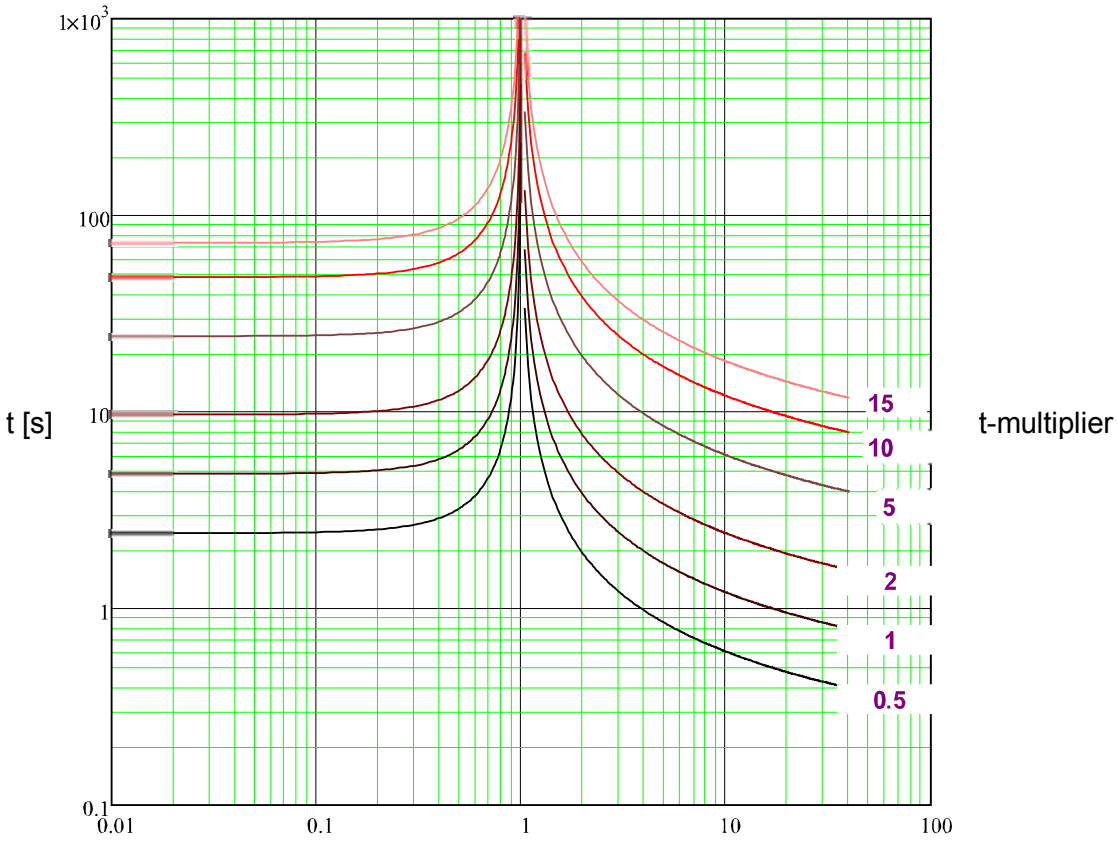
Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

Reset

$$t = \left| \frac{4.85}{\left(\frac{IG}{Pickup}\right)^{2} - 1} \right| \text{*t-multiplier [s]}$$

Trip

$$t = \left(\frac{0.0515}{\left(\frac{IG}{Pickup}\right)^{0.02} - 1} + 0.1140 \right) \text{*t-multiplier [s]}$$



ANSI VINV

Notice!

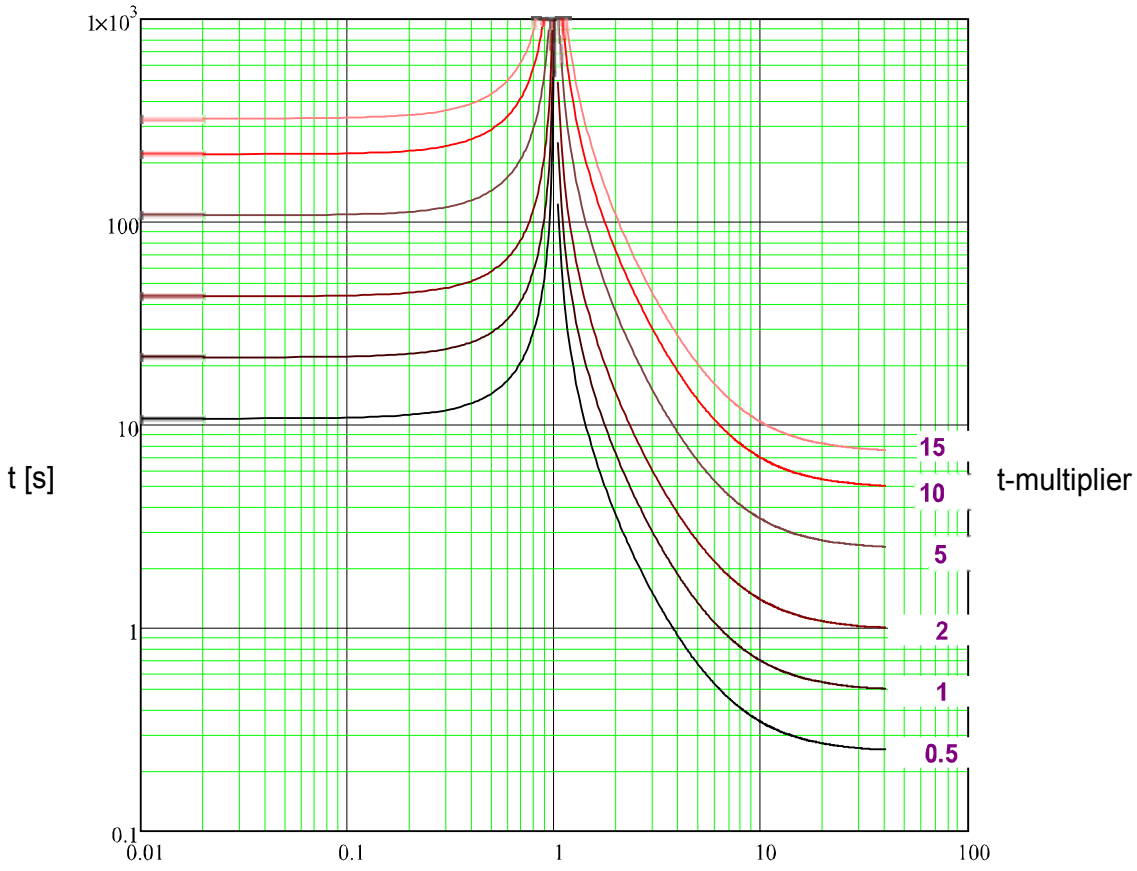
Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

Reset

$$t = \left| \frac{21.6}{\left(\frac{IG}{Pickup}\right)^2 - 1} \right| \text{*t-multiplier [s]}$$

Trip

$$t = \left(\frac{19.61}{\left(\frac{IG}{Pickup}\right)^2 - 1} + 0.491 \right) \text{*t-multiplier [s]}$$



x * Pickup (Multiples of Pickup)

ANSI EINV

Notice!

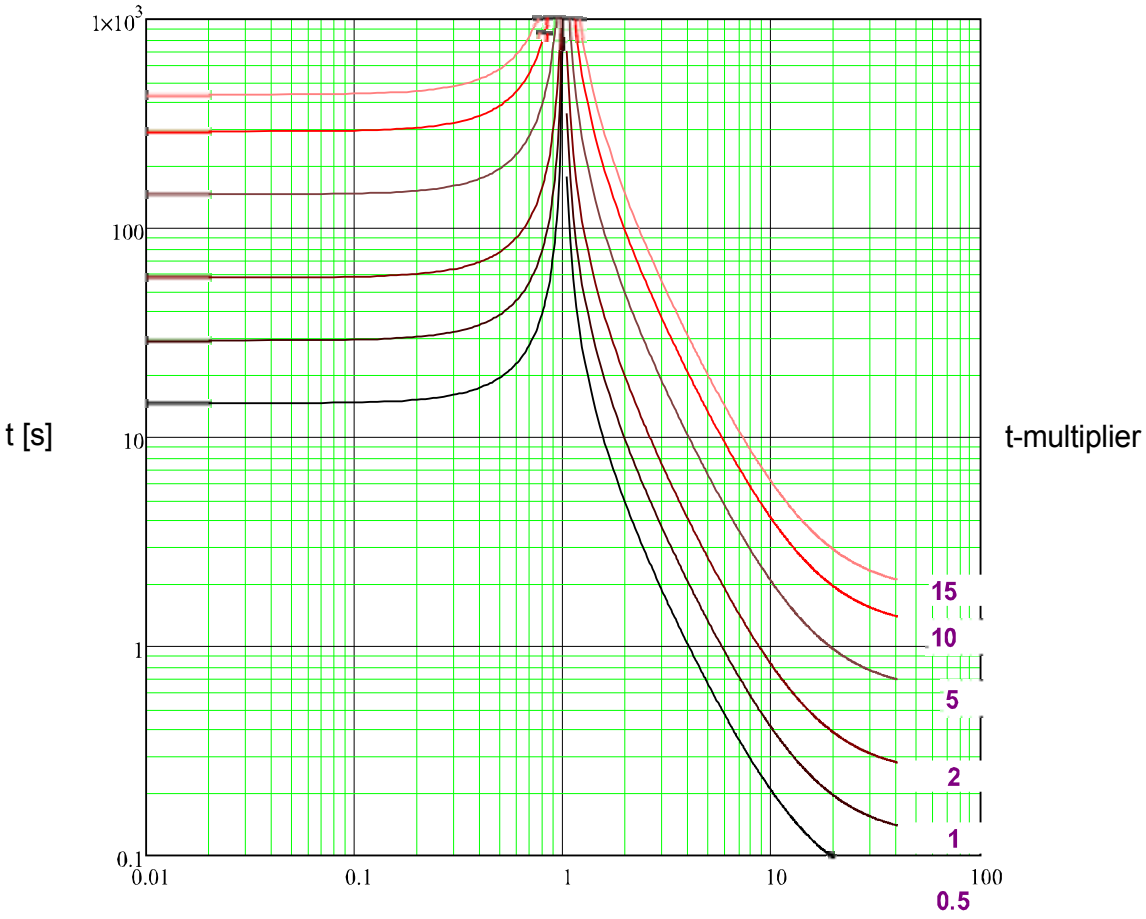
Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

Reset

$$t = \left| \frac{29.1}{\left(\frac{IG}{Pickup}\right)^2 - 1} \right| * \text{t-multiplier [s]}$$

Trip

$$t = \left(\frac{28.2}{\left(\frac{IG}{Pickup}\right)^2 - 1} + 0.1217 \right) * \text{t-multiplier [s]}$$



x * Pickup (Multiples of Pickup)

Therm Flat

Notice!

Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

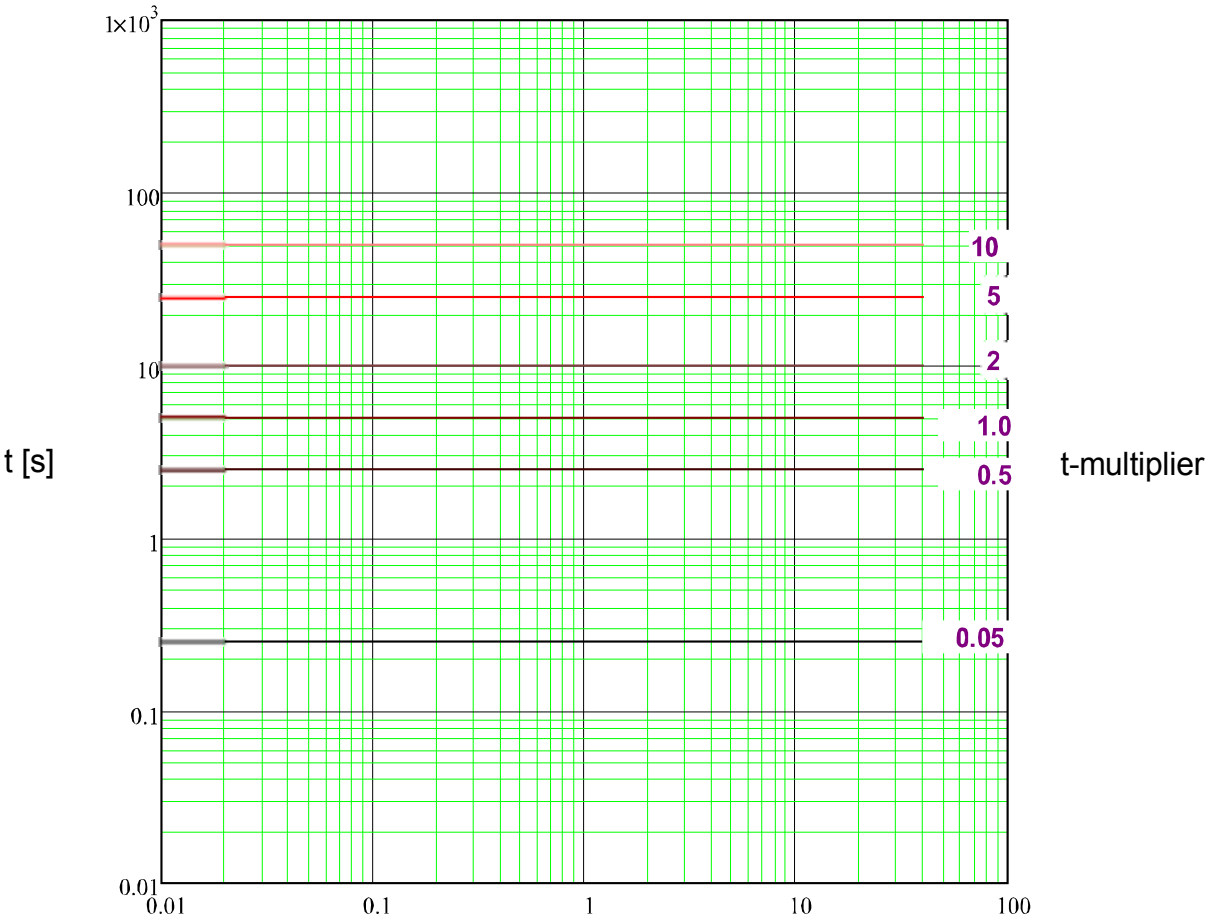
Reset

$$t = \left| \frac{5*1^{2}}{\left(\frac{IG}{IGnom}\right)^{0}} \right| *\text{t-multiplier [s]}$$

Trip

$$t = \frac{5}{\left(\frac{IG}{IGnom}\right)^{0}} *\text{t-multiplier [s]}$$

$$t = 5 *\text{t-multiplier [s]}$$



t [s] t-multiplier

x * IGnom (Multiples of the Nominal Current)

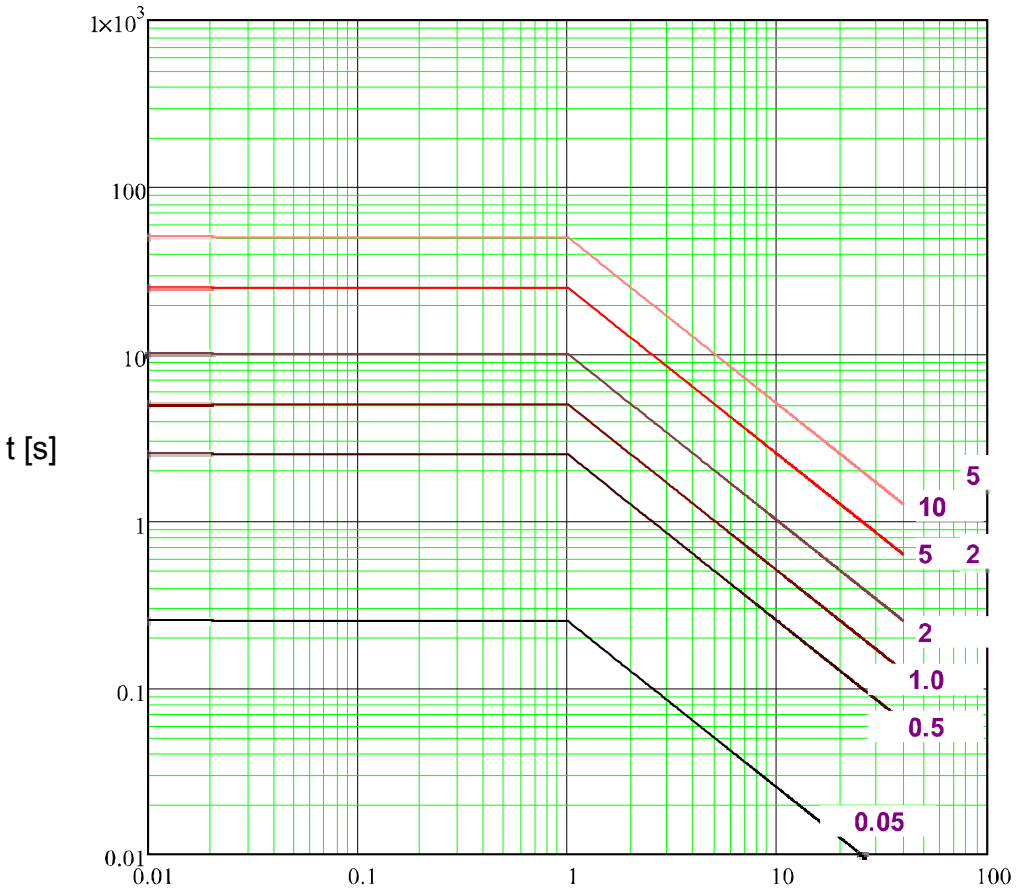
IT

Notice!

Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

Reset **Trip**

$$t = \left| \frac{5 * 1^2}{\left(\frac{IG}{IGnom}\right)^0} \right| * \text{t-multiplier [s]} \qquad t = \frac{5 * 1^1}{\left(\frac{IG}{IGnom}\right)^1} * \text{t-multiplier [s]}$$



I2T

Notice!

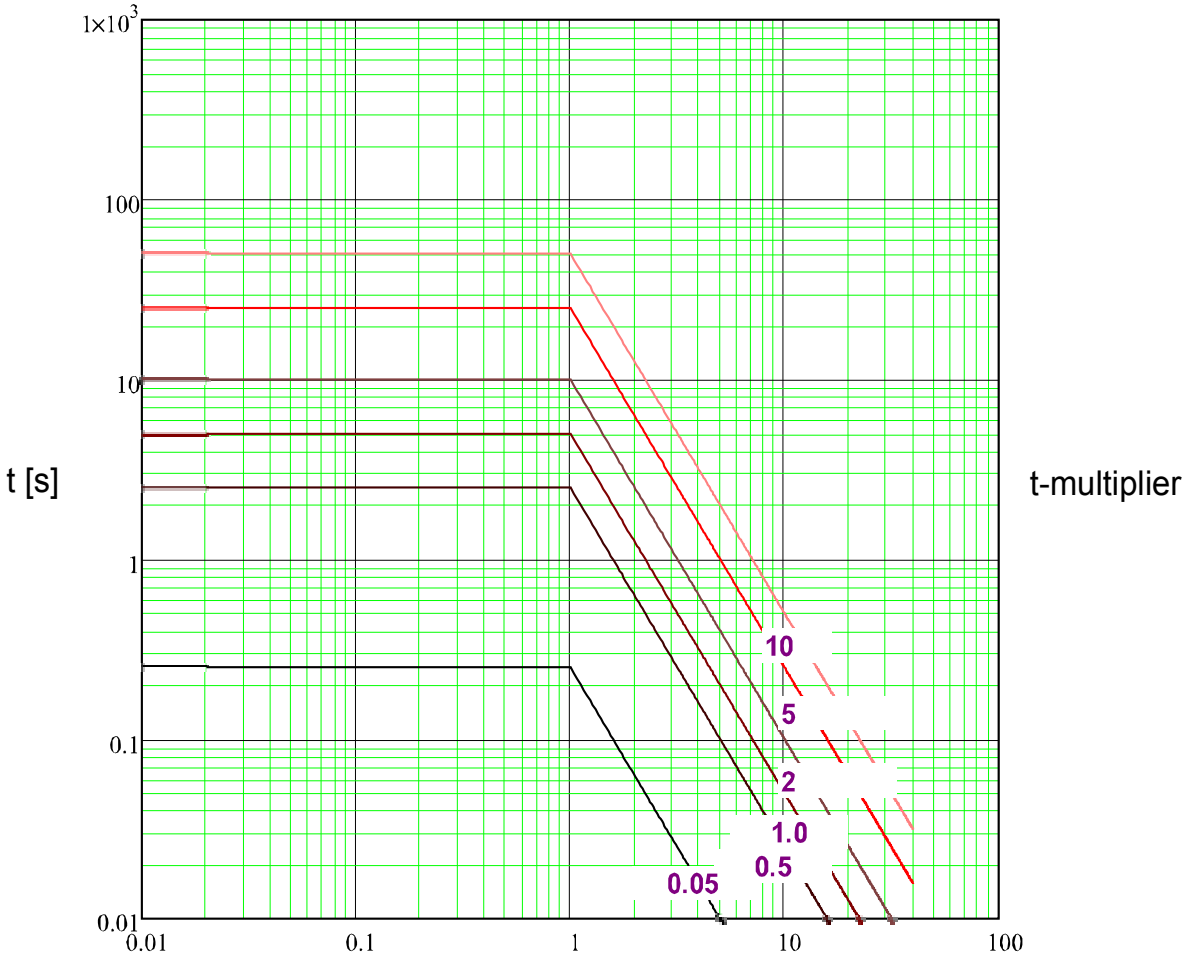
Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

Reset

$$t = \left| \frac{5 * 1^2}{\left(\frac{IG}{IGnom}\right)^0} \right| * \text{t-multiplier [s]}$$

Trip

$$t = \frac{5 * 1^2}{\left(\frac{IG}{IGnom}\right)^2} * \text{t-multiplier [s]}$$



I4T

Notice!

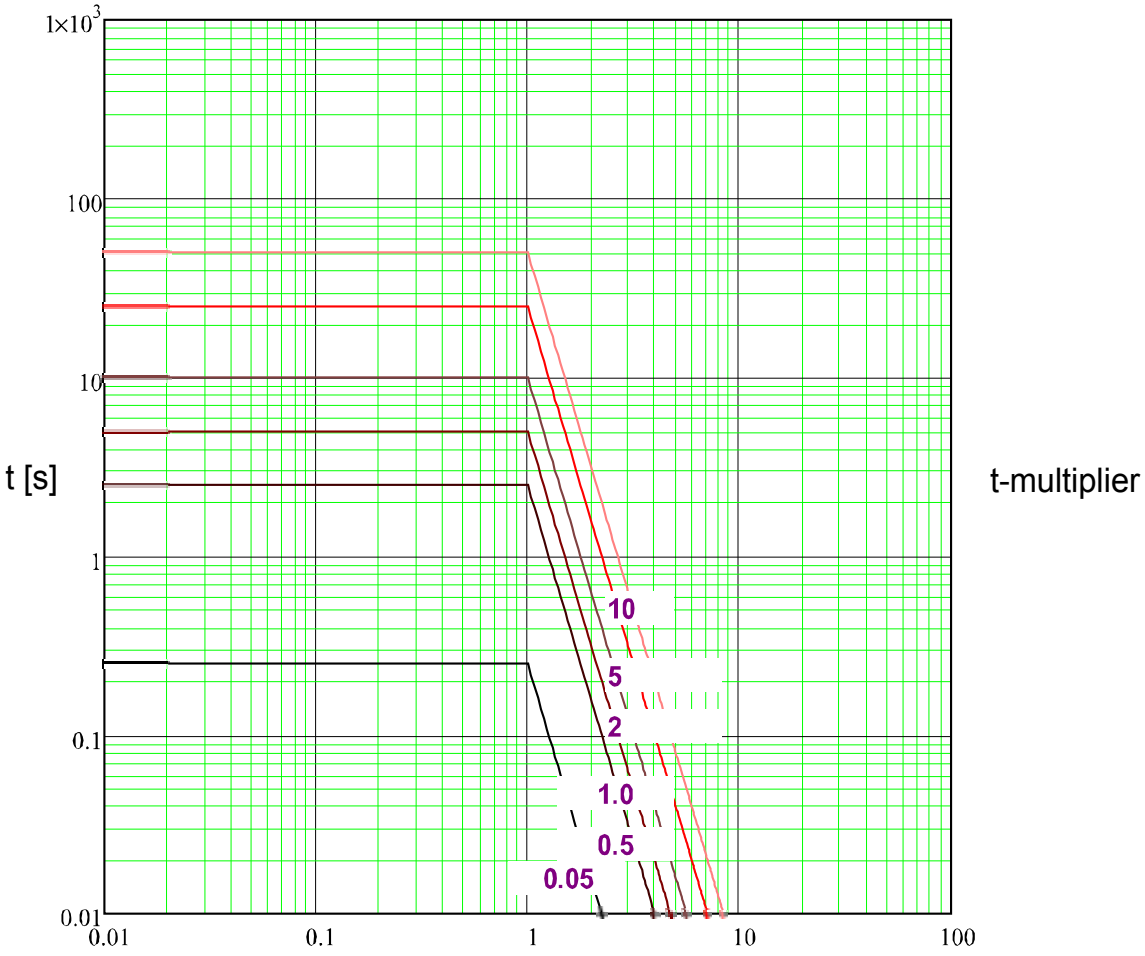
Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

Reset

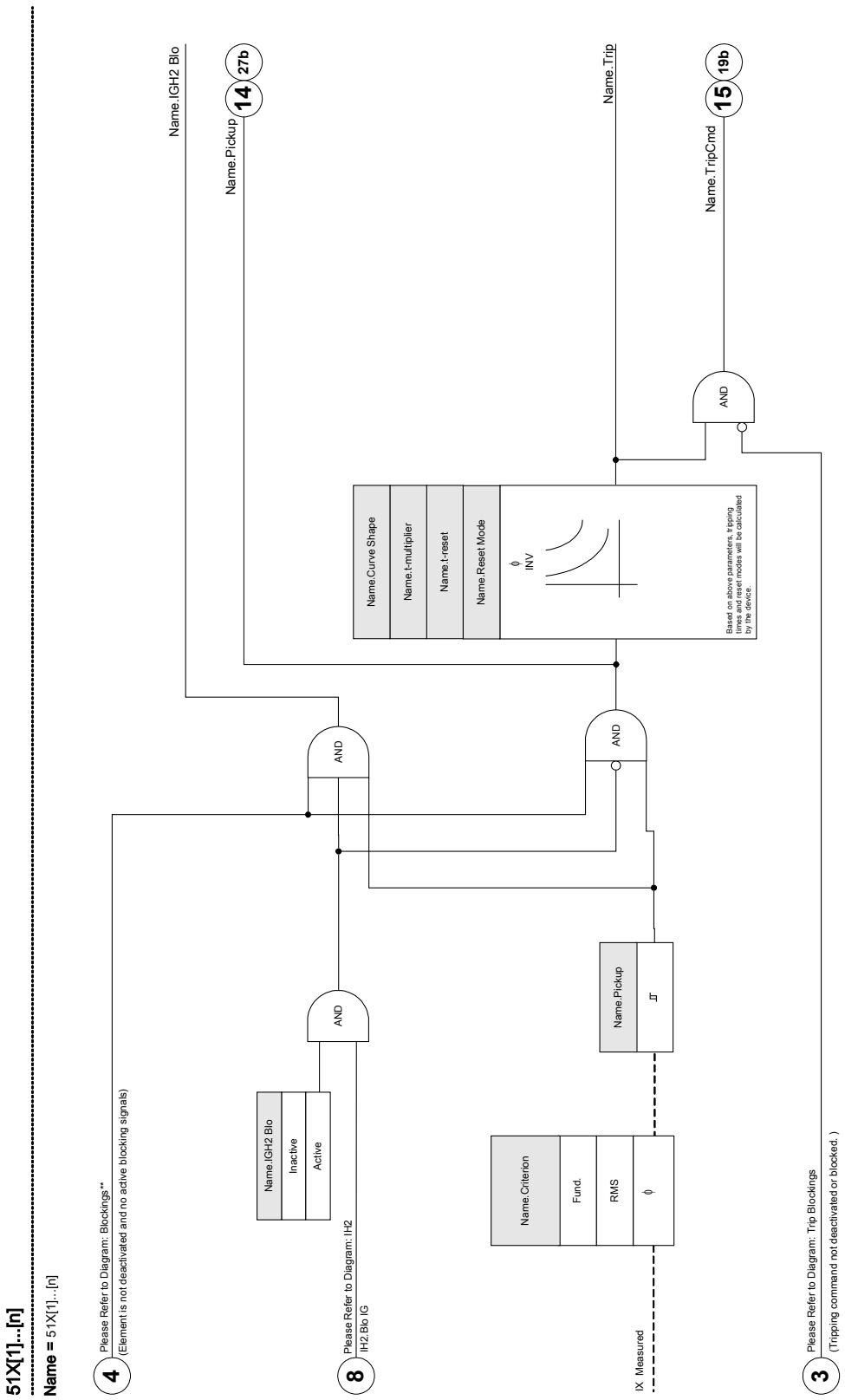
$$t = \left| \frac{5 * 1^2}{\left(\frac{IG}{IGnom}\right)^0} \right| * \text{t-multiplier [s]}$$

Trip

$$t = \frac{5 * 1^4}{\left(\frac{IG}{IGnom}\right)^4} * \text{t-multiplier [s]}$$



x * IGnom (Multiples of the Nominal Current)


51X[1]...[n]
Name = 51X[1]...[n]
4
Please Refer to Diagram: Blockings**
(Element is not deactivated and no active blocking signals)
8
Please Refer to Diagram: IH2
IH2.Blo IG
IX Measured
3
Please Refer to Diagram: Trip Blockings
(Tripping command not deactivated or blocked.)
Name.IGH2 Blo
Name.Pickup
14
27b
Name.Trip
Name.TripCmd
15
19b
AND
AND
AND
Name.IGH2 Blo
Inactive
Active
Name.Criterion
Fund.
RMS
Name.Pickup
Name.Curve Shape
Name.t-multiplier
Name.t-reset
Name.Reset Mode
INV
Based on above parameters, tripping times and reset modes will be calculated by the device.

Device Planning Parameters of the 51X Ground Fault Protection

Parameter	*Description*	*Options*	*Default*	*Menu Path*
Mode	Mode	Non-directional	Non-directional	[Device Planning]

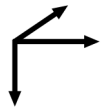
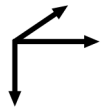
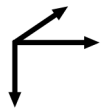
Global Protection Parameters of the 51X Ground Fault Protection

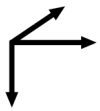
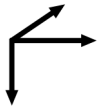
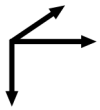
Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Winding Side	Winding Side	W1, W2	51X[1]: W1 51X[2]: W2	[Protection Para /Global Prot Para /I-Prot /51X[1]]
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /51X[1]]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /51X[1]]
ExBlo TripCmd	External blocking of the Trip Command of the module/the element, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /51X[1]]
Rvs Blo	Reverse Blocking, if Reverse Blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /51X[1]]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
AdaptSet 1	Assignment Adaptive Parameter 1	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /51X[1]]
AdaptSet 2	Assignment Adaptive Parameter 2	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /51X[1]]
AdaptSet 3	Assignment Adaptive Parameter 3	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /51X[1]]
AdaptSet 4	Assignment Adaptive Parameter 4	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /51X[1]]

Setting Group Parameters of the 51X Ground Fault Protection

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Function	Permanent activation or deactivation of module/element.	Inactive, Active	51X[1]: Inactive 51X[2]: Active	[Protection Para /<n> /I-Prot /51X[1]]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /51X[1]]
Rvs Blo Fc	Activate (allow) or inactivate (disallow) reverse blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/element are blocked that are parameterized "Rvs Blo Fc = active".	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /51X[1]]
Blo TripCmd	Permanent blocking of the Trip Command of the module/element.	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /51X[1]]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
ExBlo TripCmd Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo TripCmd Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /51X[1]]
Criterion	Measuring method: fundamental or rms	Fundamental, True RMS	True RMS	[Protection Para /<n> /I-Prot /51X[1]]
Pickup 	If the pickup value is exceeded, the module/element will be started.	0.01 - 20.00In	0.5In	[Protection Para /<n> /I-Prot /51X[1]]
Curve Shape 	Characteristic	IEC NINV, IEC VINV, IEC EINV, IEC LINV, ANSI MINV, ANSI VINV, ANSI EINV, Therm Flat, IT, I2T, I4T	ANSI MINV	[Protection Para /<n> /I-Prot /51X[1]]
t-multiplier 	Time multiplier/tripping characteristic factor	0.05 - 20.00	51X[1]: 1.0 51X[2]: 1	[Protection Para /<n> /I-Prot /51X[1]]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Reset Mode 	Reset Mode	Instantaneous, t-delay, Calculated	Calculated	[Protection Para /<n> /I-Prot /51X[1]]
t-reset 	Reset time for intermittent phase failures (INV characteristics only) Only available if:Reset Mode = t-delay	0.00 - 60.00s	0.00s	[Protection Para /<n> /I-Prot /51X[1]]
IH2 Blo 	Blocking the trip command, if an inrush is detected.	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /51X[1]]

51X Ground Fault Protection Input States

Name	*Description*	*Assignment Via*
ExBlo1-I	Module Input State: External Blocking1	[Protection Para /Global Prot Para /I-Prot /51X[1]]
ExBlo2-I	Module Input State: External Blocking2	[Protection Para /Global Prot Para /I-Prot /51X[1]]
ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command	[Protection Para /Global Prot Para /I-Prot /51X[1]]
Rvs Blo-I	Module Input State: Reverse Blocking	[Protection Para /Global Prot Para /I-Prot /51X[1]]
AdaptSet1-I	Module Input State: Adaptive Parameter1	[Protection Para /Global Prot Para /I-Prot /51X[1]]
AdaptSet2-I	Module Input State: Adaptive Parameter2	[Protection Para /Global Prot Para /I-Prot /51X[1]]
AdaptSet3-I	Module Input State: Adaptive Parameter3	[Protection Para /Global Prot Para /I-Prot /51X[1]]
AdaptSet4-I	Module Input State: Adaptive Parameter4	[Protection Para /Global Prot Para /I-Prot /51X[1]]

51X Ground Fault Protection Signals (Output States)

Name	*Description*
Active	Signal: Active
ExBlo	Signal: External Blocking
Rvs Blo	Signal: Reverse Blocking

Name	*Description*
Blo TripCmd	Signal: Trip Command blocked
ExBlo TripCmd	Signal: External Blocking of the Trip Command
Pickup	Signal: Pickup IX or IR
Trip	Signal: Trip
TripCmd	Signal: Trip Command
IGH2 Blo	Signal: Blocked by IH2
Active AdaptSet	Active Adaptive Parameter
DefaultSet	Signal: Default Parameter Set
AdaptSet 1	Signal: Adaptive Parameter 1
AdaptSet 2	Signal: Adaptive Parameter 2
AdaptSet 3	Signal: Adaptive Parameter 3
AdaptSet 4	Signal: Adaptive Parameter 4

Commissioning: Ground Fault Protection – Non-directional [ANSI 51X]

Please test the non-directional ground overcurrent analog to the non-directional phase overcurrent protection.

50R DEFT Calculated Ground Fault Protection Module [ANSI 50R]

Elements
50R[1] ,50R[2]

WARNING **If you are using inrush blockings, the tripping delay of the ground current protection functions must be at least 30 ms or more in order to prevent faulty trippings.**

NOTICE **All ground current elements are identically structured.**

For each element, the following characteristics are available:

- DEFT (definite time).

Explanation:

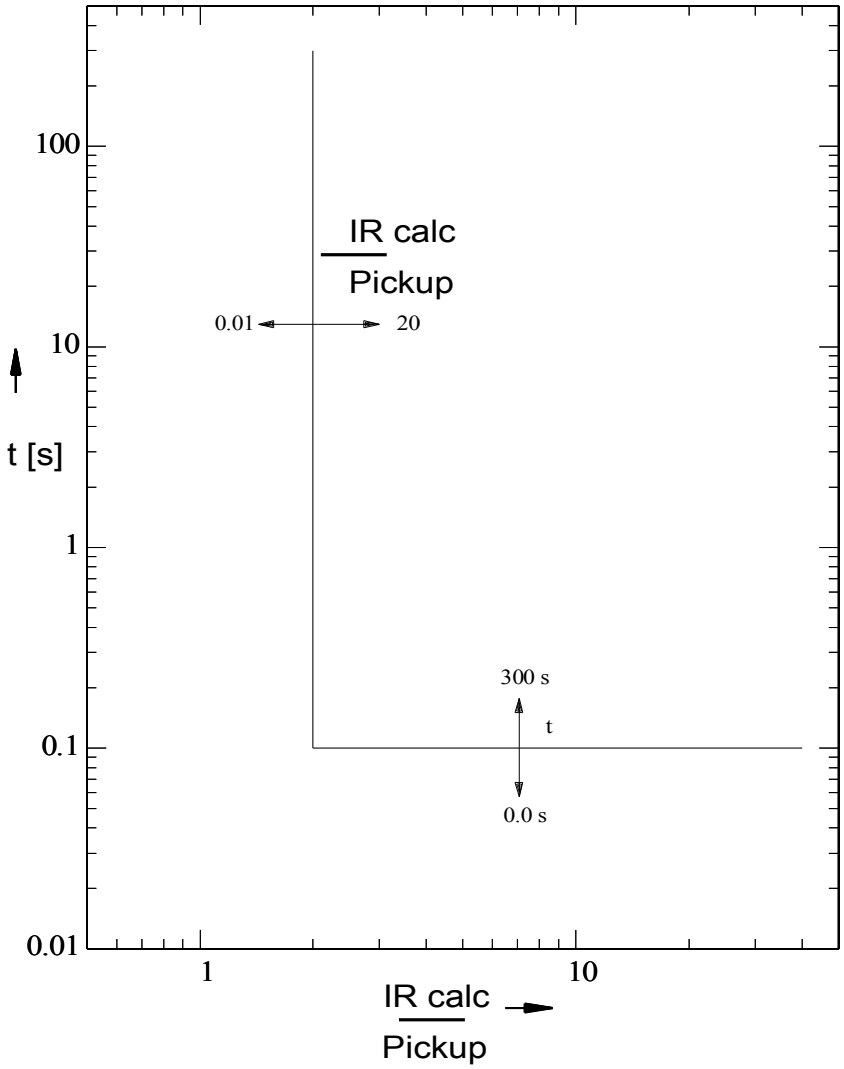
t = Tripping delay

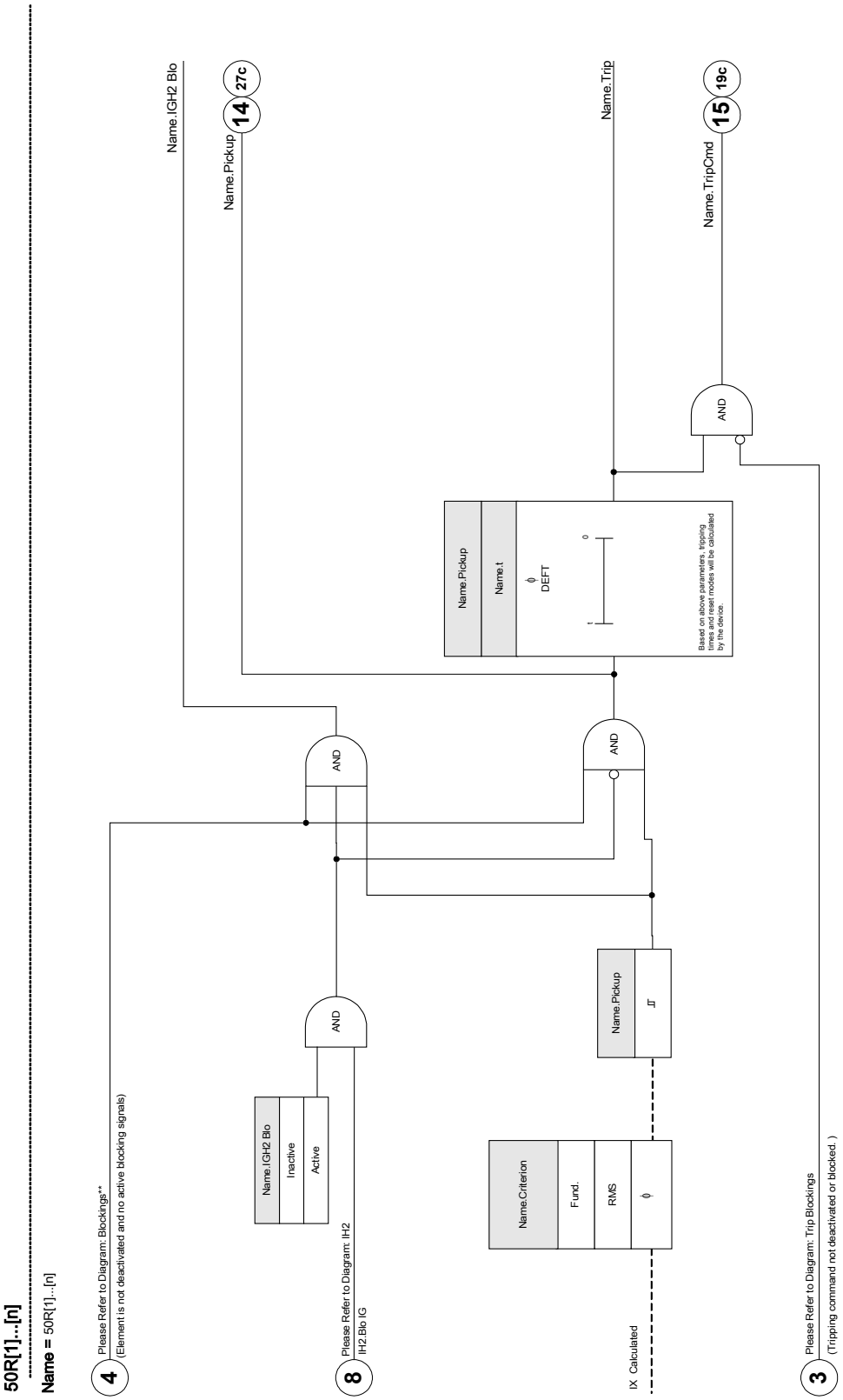
IG = Fault current

Pickup = If the pickup value is exceeded, the module/element starts to time out to trip.

The ground current can be measured either directly via a zero sequence transformer or detected by a residual connection. The ground current can alternatively be calculated from the phase currents; but this is only possible if the current transformers are Wye-connected.

DEFT


100
10
1
0.1
0.01
t [s]
IR calc
Pickup
0.01
20
300 s
t
0.0 s
1
10
IR calc
Pickup


50R[1]...[n]
Name = 50R[1]...[n]
4
Please Refer to Diagram: Blockings**
(Element is not deactivated and no active blocking signals)
8
Please Refer to Diagram: IH2
IH2.Blo IG
IX Calculated
Name.IGH2 Blo
Inactive
Active
AND
Name.Criterion
Fund.
RMS
Name.Pickup
Name.IGH2 Blo
Name.Pickup
14
27c
Name.Trip
Name.Pickup
Name.t
DEFT
t
0
Based on above parameters, tripping times and reset modes will be calculated by the device.
AND
Name.TripCmd
15
19c
AND
3
Please Refer to Diagram: Trip Blockings
(Tripping command not deactivated or blocked.)

Device Planning Parameters of the 50R Ground Fault Protection

Parameter	*Description*	*Options*	*Default*	*Menu Path*
Mode	Mode	Non-directional	Non-directional	[Device Planning]

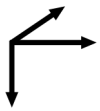
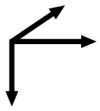
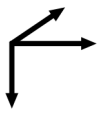
Global Protection Parameters of the 50R Ground Fault Protection

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Winding Side	Winding Side	W1, W2	50R[1]: W1 50R[2]: W2	[Protection Para /Global Prot Para /I-Prot /50R[1]]
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /50R[1]]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /50R[1]]
ExBlo TripCmd	External blocking of the Trip Command of the module/the element, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /50R[1]]
Rvs Blo	Reverse Blocking, if Reverse Blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /50R[1]]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
AdaptSet 1	Assignment Adaptive Parameter 1	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /50R[1]]
AdaptSet 2	Assignment Adaptive Parameter 2	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /50R[1]]
AdaptSet 3	Assignment Adaptive Parameter 3	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /50R[1]]
AdaptSet 4	Assignment Adaptive Parameter 4	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /50R[1]]

Setting Group Parameters of the 50R Ground Fault Protection

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Function	Permanent activation or deactivation of module/element.	Inactive, Active	50R[1]: Inactive 50R[2]: Active	[Protection Para /<n> /I-Prot /50R[1]]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /50R[1]]
Rvs Blo Fc	Activate (allow) or inactivate (disallow) reverse blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/element are blocked that are parameterized "Rvs Blo Fc = active".	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /50R[1]]
Blo TripCmd	Permanent blocking of the Trip Command of the module/element.	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /50R[1]]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
ExBlo TripCmd Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo TripCmd Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /50R[1]]
Criterion	Measuring method: fundamental or rms	Fundamental, True RMS	True RMS	[Protection Para /<n> /I-Prot /50R[1]]
Pickup 	If the pickup value is exceeded, the module/element will be started. Only available if: Characteristic = DEFT Or Characteristic = INV	0.01 - 20.00In	50R[1]: 1In 50R[2]: 1.0In	[Protection Para /<n> /I-Prot /50R[1]]
t 	Tripping delay Only available if: Characteristic = DEFT	0.00 - 300.00s	0.5s	[Protection Para /<n> /I-Prot /50R[1]]
IH2 Blo 	Blocking the trip command, if an inrush is detected.	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /50R[1]]

50R Ground Fault Protection Input States

Name	*Description*	*Assignment Via*
ExBlo1-I	Module Input State: External Blocking1	[Protection Para /Global Prot Para /I-Prot /50R[1]]
ExBlo2-I	Module Input State: External Blocking2	[Protection Para /Global Prot Para /I-Prot /50R[1]]
ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command	[Protection Para /Global Prot Para /I-Prot /50R[1]]
Rvs Blo-I	Module Input State: Reverse Blocking	[Protection Para /Global Prot Para /I-Prot /50R[1]]
AdaptSet1-I	Module Input State: Adaptive Parameter1	[Protection Para /Global Prot Para /I-Prot /50R[1]]
AdaptSet2-I	Module Input State: Adaptive Parameter2	[Protection Para /Global Prot Para /I-Prot /50R[1]]
AdaptSet3-I	Module Input State: Adaptive Parameter3	[Protection Para /Global Prot Para /I-Prot /50R[1]]
AdaptSet4-I	Module Input State: Adaptive Parameter4	[Protection Para /Global Prot Para /I-Prot /50R[1]]

50R Ground Fault Protection Signals (Output States)

Name	*Description*
Active	Signal: Active
ExBlo	Signal: External Blocking
Rvs Blo	Signal: Reverse Blocking
Blo TripCmd	Signal: Trip Command blocked
ExBlo TripCmd	Signal: External Blocking of the Trip Command
Pickup	Signal: Pickup IX or IR
Trip	Signal: Trip
TripCmd	Signal: Trip Command
IGH2 Blo	Signal: Blocked by IH2
Active AdaptSet	Active Adaptive Parameter
DefaultSet	Signal: Default Parameter Set
AdaptSet 1	Signal: Adaptive Parameter 1
AdaptSet 2	Signal: Adaptive Parameter 2
AdaptSet 3	Signal: Adaptive Parameter 3
AdaptSet 4	Signal: Adaptive Parameter 4

Commissioning: Ground Fault Protection – Non-directional [ANSI 50R]

Please test the non-directional ground overcurrent analog to the non-directional phase overcurrent protection.

51R INV Calculated Ground Fault Protection Module [ANSI 51R]

Elements
51R[1] ,51R[2]

NOTICE **All ground current elements are identically structured.**

For each element the following characteristics are available:

- NINV (IEC/XInv);
- VINV (IEC/XInv);
- LINV (IEC/XInv);
- EINV (IEC/XInv);
- MINV (ANSI/XInv);
- VINV (ANSI/XInv);
- EINV (ANSI/XInv);
- Thermal Flat;
- Therm Flat IT;
- Therm Flat I2T; and
- Therm Flat I4T.

Explanation:

t = Tripping delay

t-multiplier = Time multiplier/tripping characteristic factor

IG = Fault current

Pickup = If the pickup value is exceeded, the module/element starts to time out to trip.

The ground current can be measured either directly via a zero sequence transformer or detected by a residual connection. The ground current can alternatively be calculated from the phase currents; but this is only possible if the current transformers are Wye-connected.

IEC NINV

Notice!

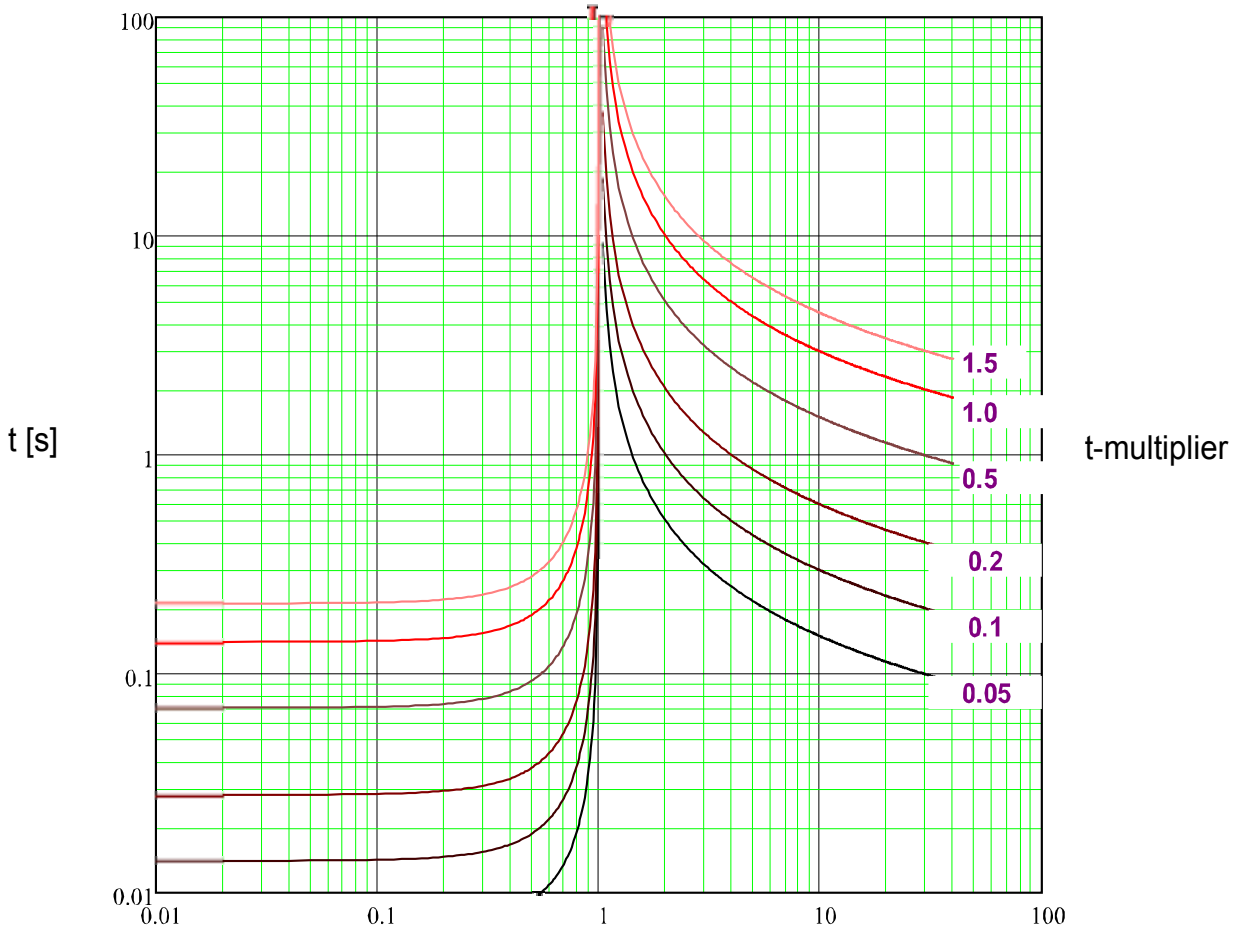
Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

Reset

$$t = \left| \frac{0.14}{\left(\frac{IG}{Pickup}\right)^{2} - 1} \right| * \text{t-multiplier [s]}$$

Trip

$$t = \frac{0.14}{\left(\frac{IG}{Pickup}\right)^{0.02} - 1} * \text{t-multiplier [s]}$$



IEC VINV

Notice!

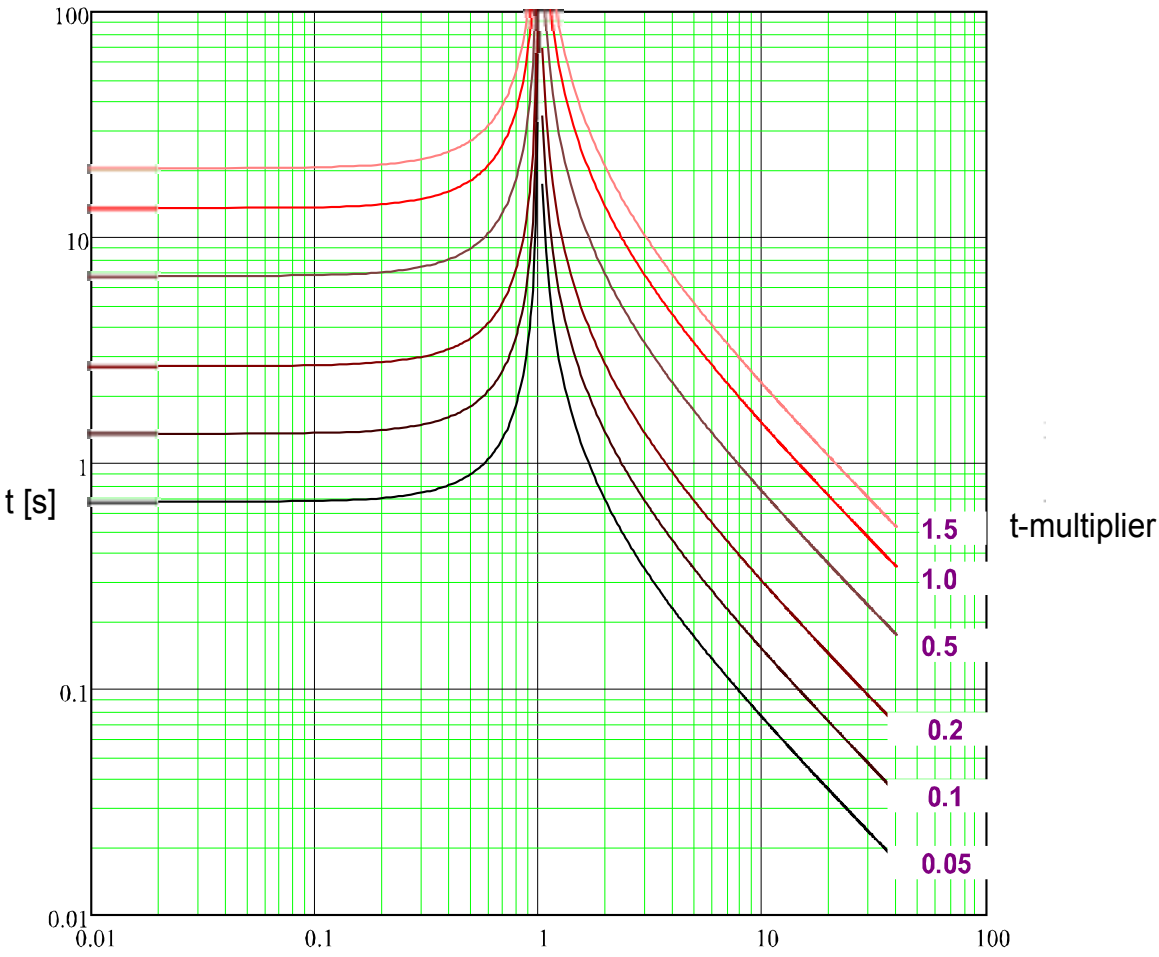
Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

Reset

$$t = \left| \frac{13.5}{\left(\frac{IG}{Pickup}\right)^2 - 1} \right| \text{*t-multiplier [s]}$$

Trip

$$t = \frac{13.5}{\left(\frac{IG}{Pickup}\right) - 1} \text{*t-multiplier [s]}$$



IEC LINV

Notice!

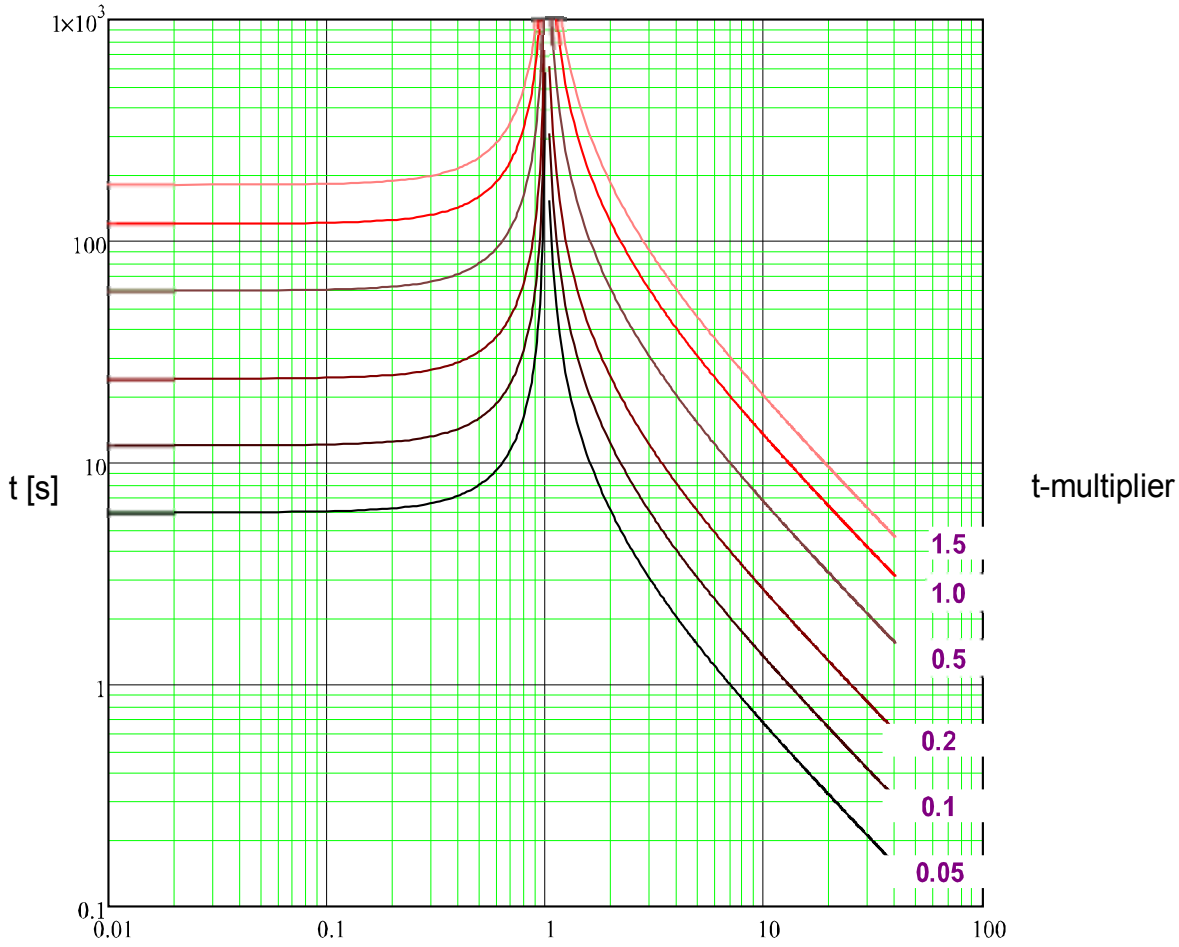
Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

Reset

$$t = \left| \frac{120}{\left(\frac{IG}{Pickup}\right)^2 - 1} \right| * \text{t-multiplier [s]}$$

Trip

$$t = \frac{120}{\left(\frac{IG}{Pickup}\right) - 1} * \text{t-multiplier [s]}$$



IEC EINV

Notice!

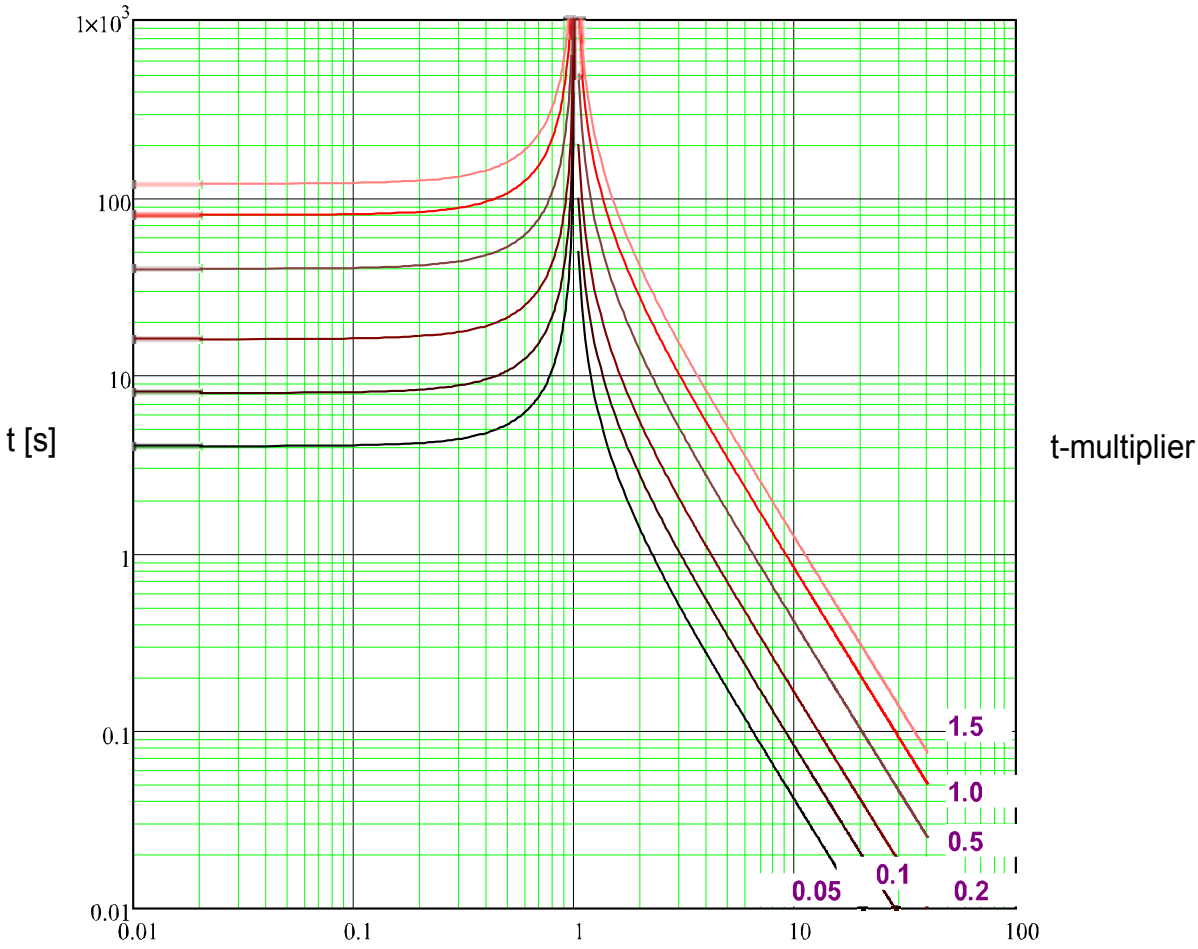
Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

Reset

$$t = \left| \frac{80}{\left(\frac{IG}{Pickup}\right)^2 - 1} \right| * \text{t-multiplier [s]}$$

Trip

$$t = \frac{80}{\left(\frac{IG}{Pickup}\right)^2 - 1} * \text{t-multiplier [s]}$$



ANSI MINV

Notice!

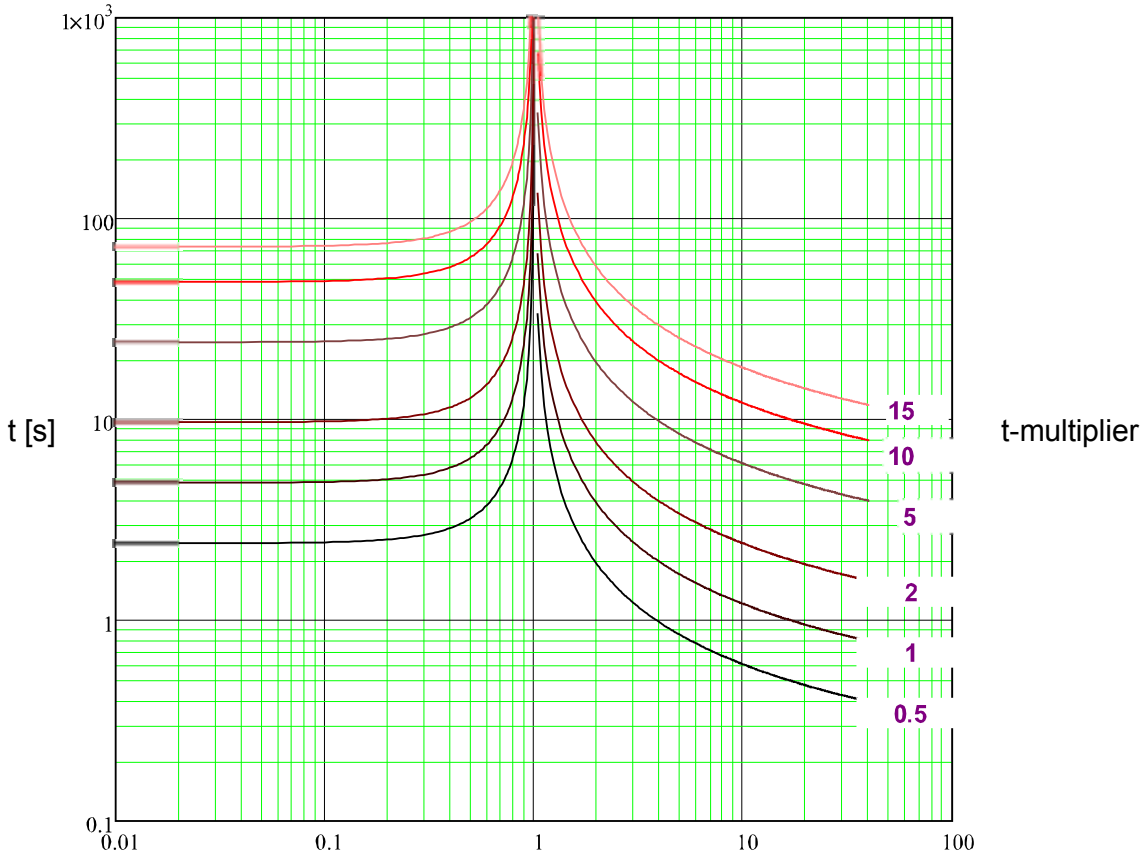
Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

Reset

$$t = \left| \frac{4.85}{\left(\frac{IG}{Pickup}\right)^{2} - 1} \right| * \text{t-multiplier [s]}$$

Trip

$$t = \left(\frac{0.0515}{\left(\frac{IG}{Pickup}\right)^{0.02} - 1} + 0.1140 \right) * \text{t-multiplier [s]}$$



ANSI VINV

Notice!

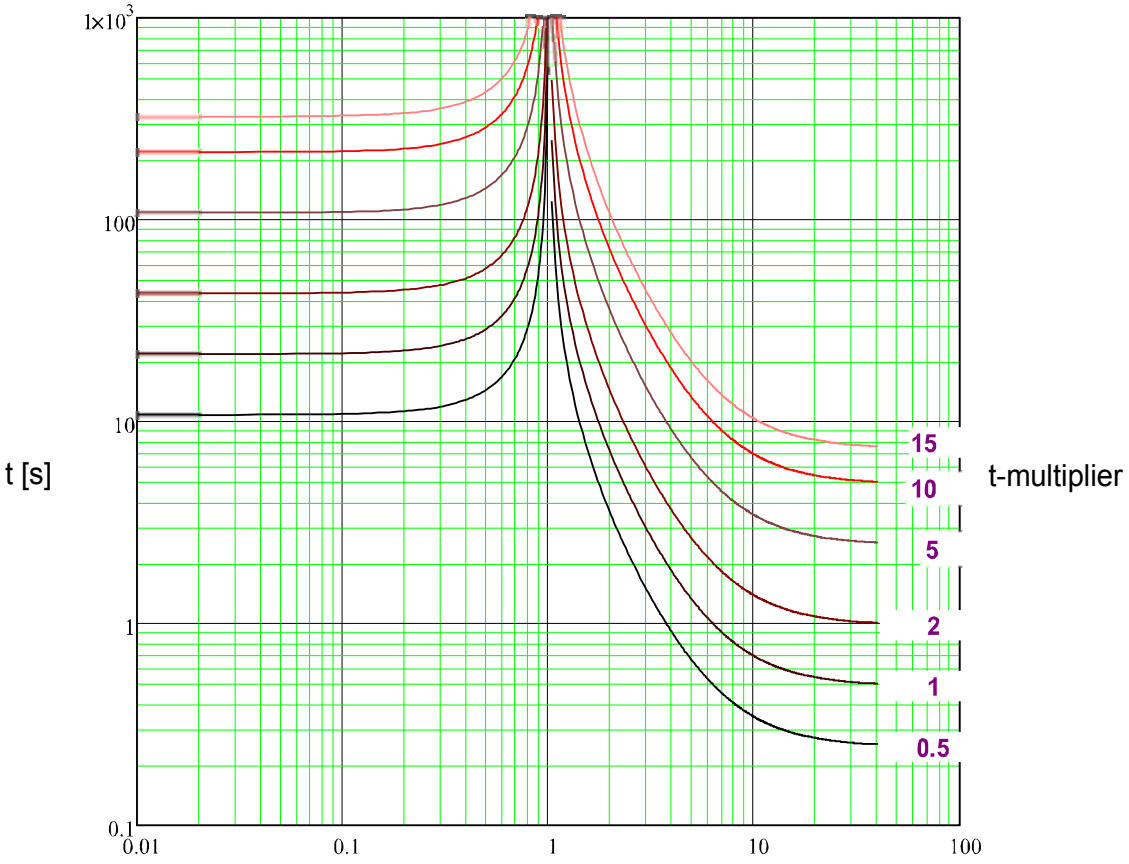
Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

Reset

$$t = \left| \frac{21.6}{\left(\frac{IG}{Pickup}\right)^2 - 1} \right| \text{*t-multiplier [s]}$$

Trip

$$t = \left(\frac{19.61}{\left(\frac{IG}{Pickup}\right)^2 - 1} + 0.491 \right) \text{*t-multiplier [s]}$$



x * Pickup (Multiples of Pickup)

ANSI EINV

Notice!

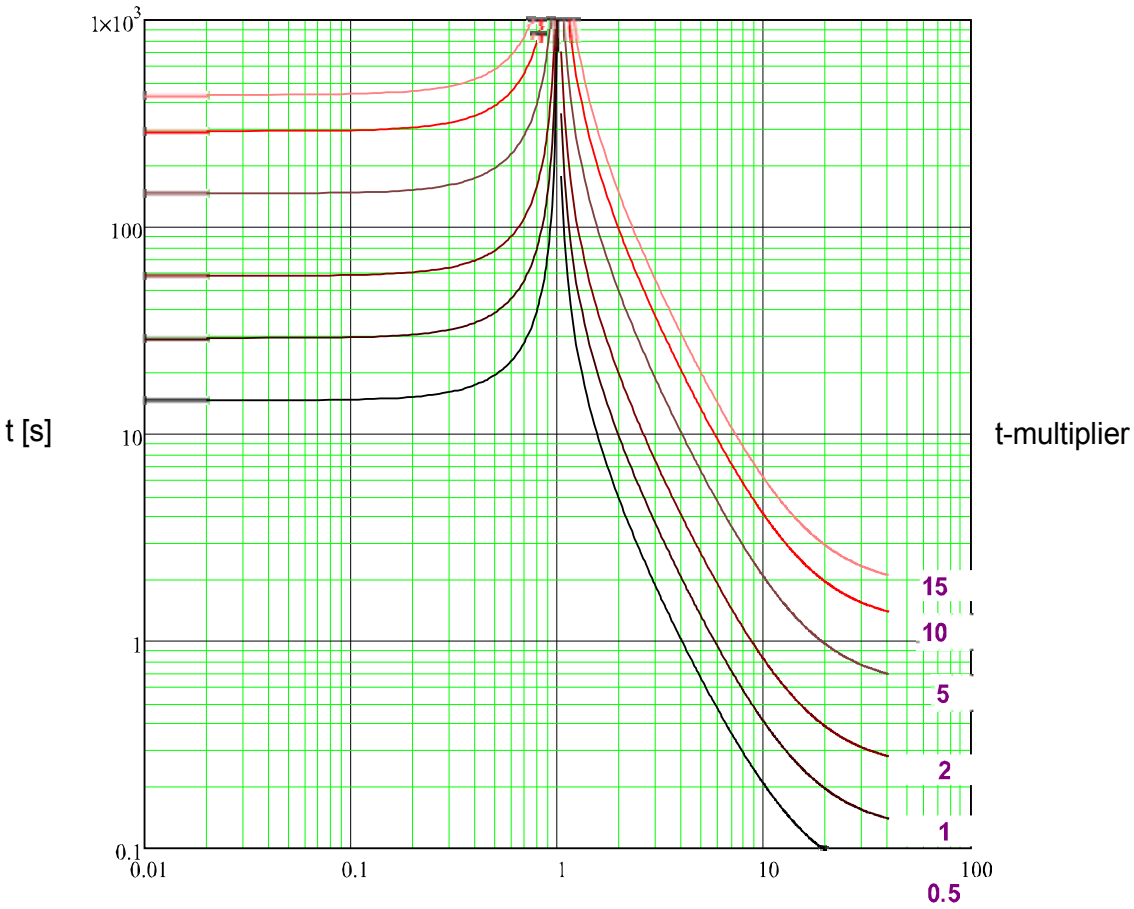
Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

Reset

$$t = \left| \frac{29.1}{\left(\frac{IG}{Pickup}\right)^2 - 1} \right| \text{*t-multiplier [s]}$$

Trip

$$t = \left(\frac{28.2}{\left(\frac{IG}{Pickup}\right)^2 - 1} + 0.1217 \right) \text{*t-multiplier [s]}$$



Therm Flat

Notice!

Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

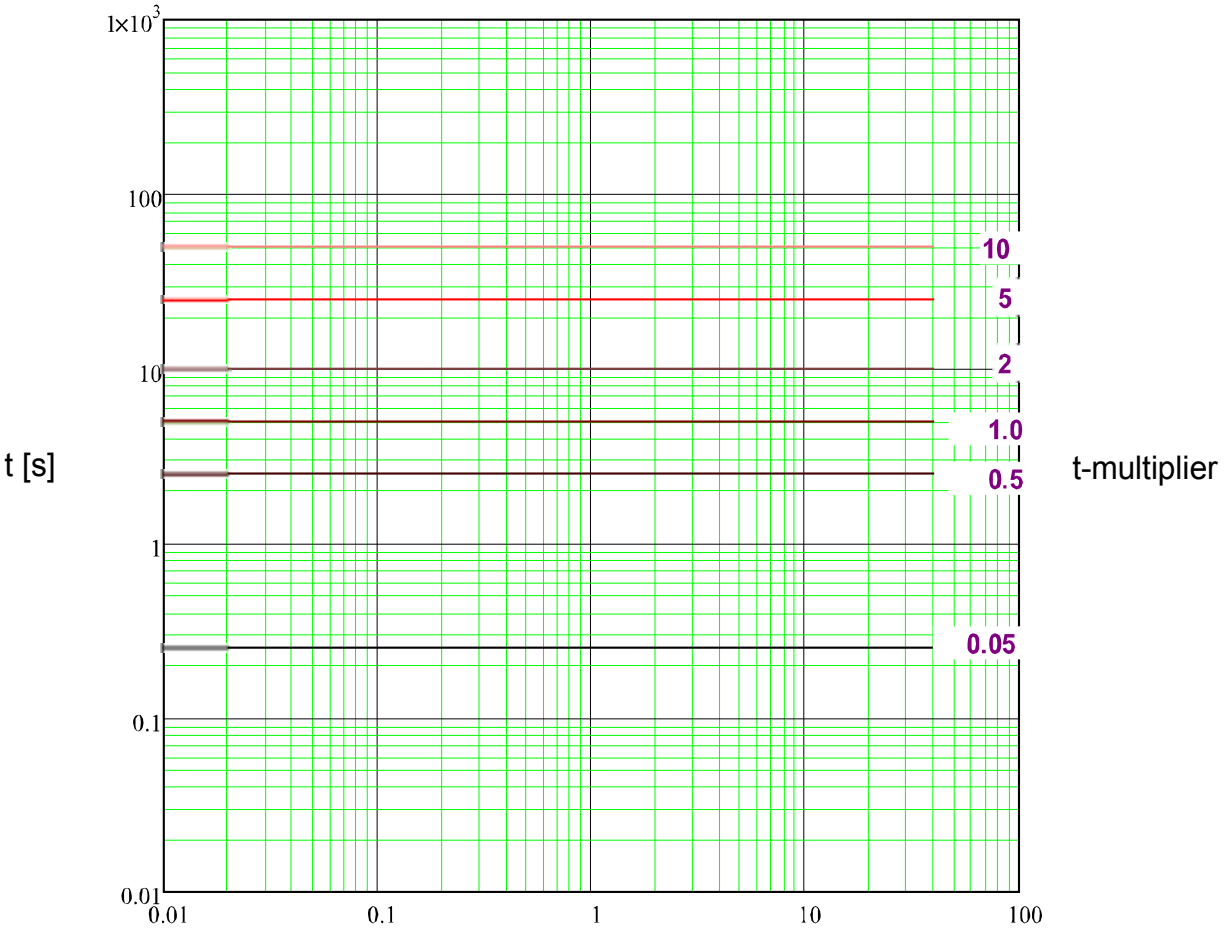
Reset

$$t = \left| \frac{5 * 1^{2}}{\left(\frac{IG}{IGnom}\right)^{0}} \right| * \text{t-multiplier [s]}$$

Trip

$$t = \frac{5}{\left(\frac{IG}{IGnom}\right)^{0}} * \text{t-multiplier [s]}$$

$$t = 5 * \text{t-multiplier [s]}$$



t [s]

t-multiplier

x * IGnom (Multiples of the Nominal Current)

IT

Notice!

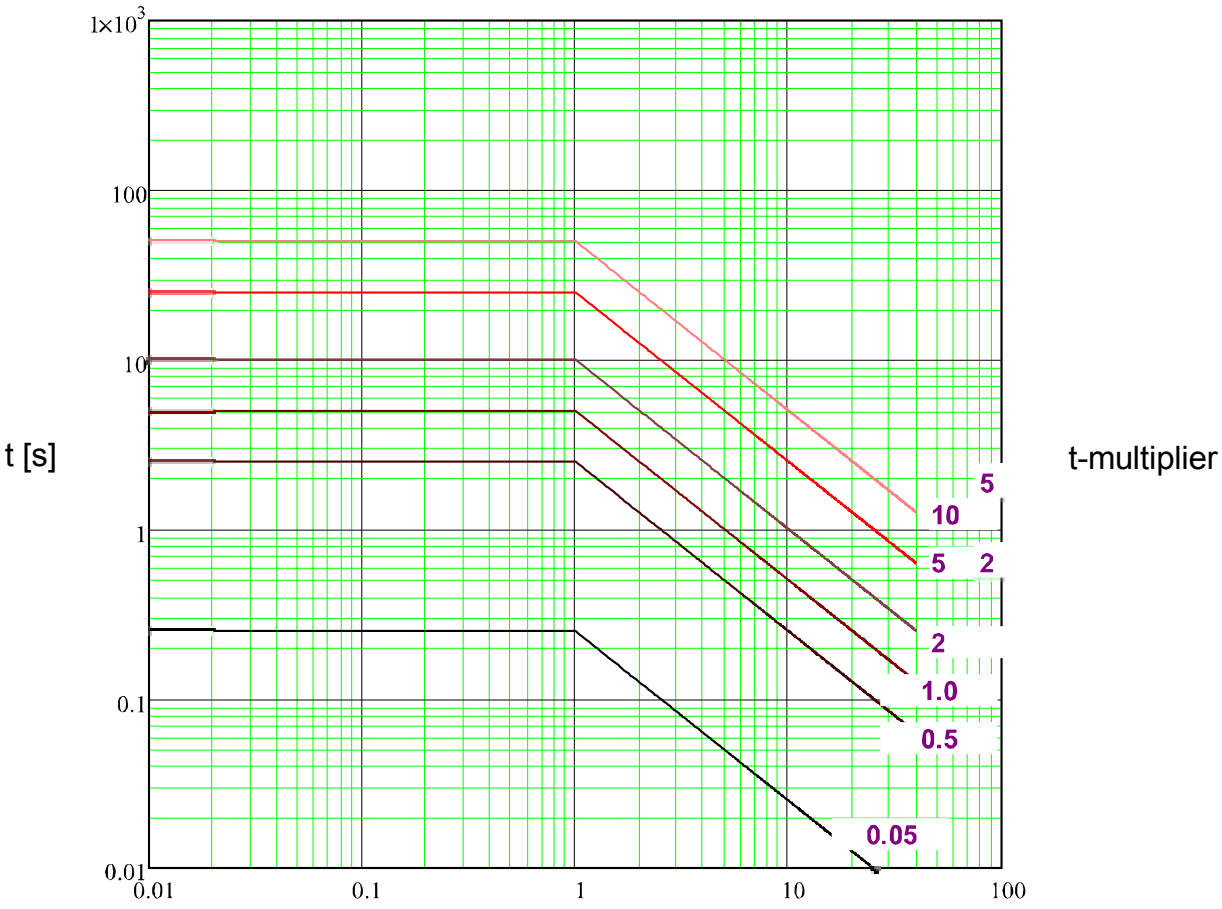
Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

Reset

$$t = \left| \frac{5 * 1^{2}}{\left(\frac{IG}{IGnom}\right)^{0}} \right| * \text{t-multiplier [s]}$$

Trip

$$t = \frac{5 * 1^{1}}{\left(\frac{IG}{IGnom}\right)^{1}} * \text{t-multiplier [s]}$$



I2T

Notice!

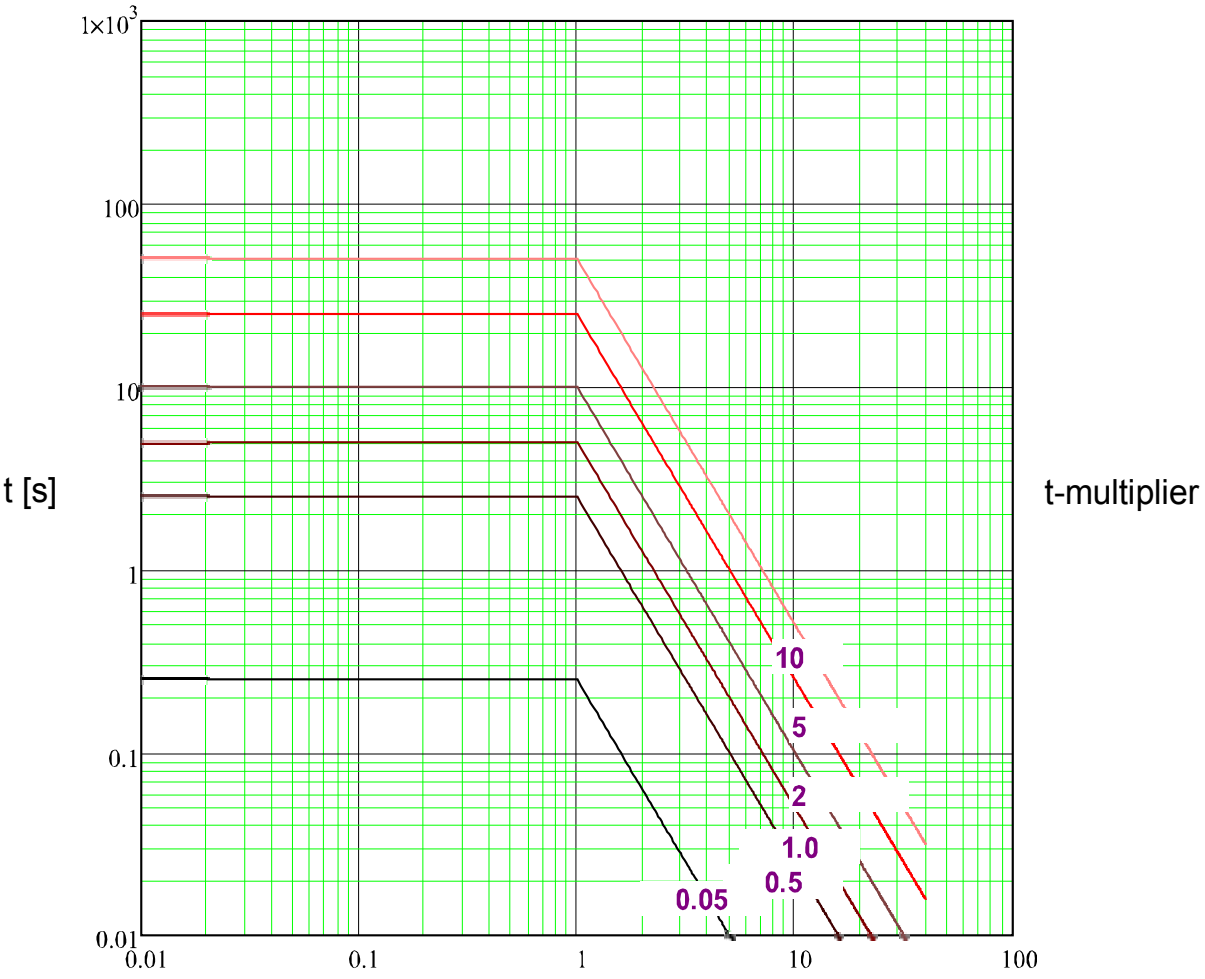
Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

Reset

$$t = \left| \frac{5 * 1^2}{\left(\frac{IG}{IGnom}\right)^0} \right| * \text{t-multiplier [s]}$$

Trip

$$t = \frac{5 * 1^2}{\left(\frac{IG}{IGnom}\right)^2} * \text{t-multiplier [s]}$$



I4T

Notice!

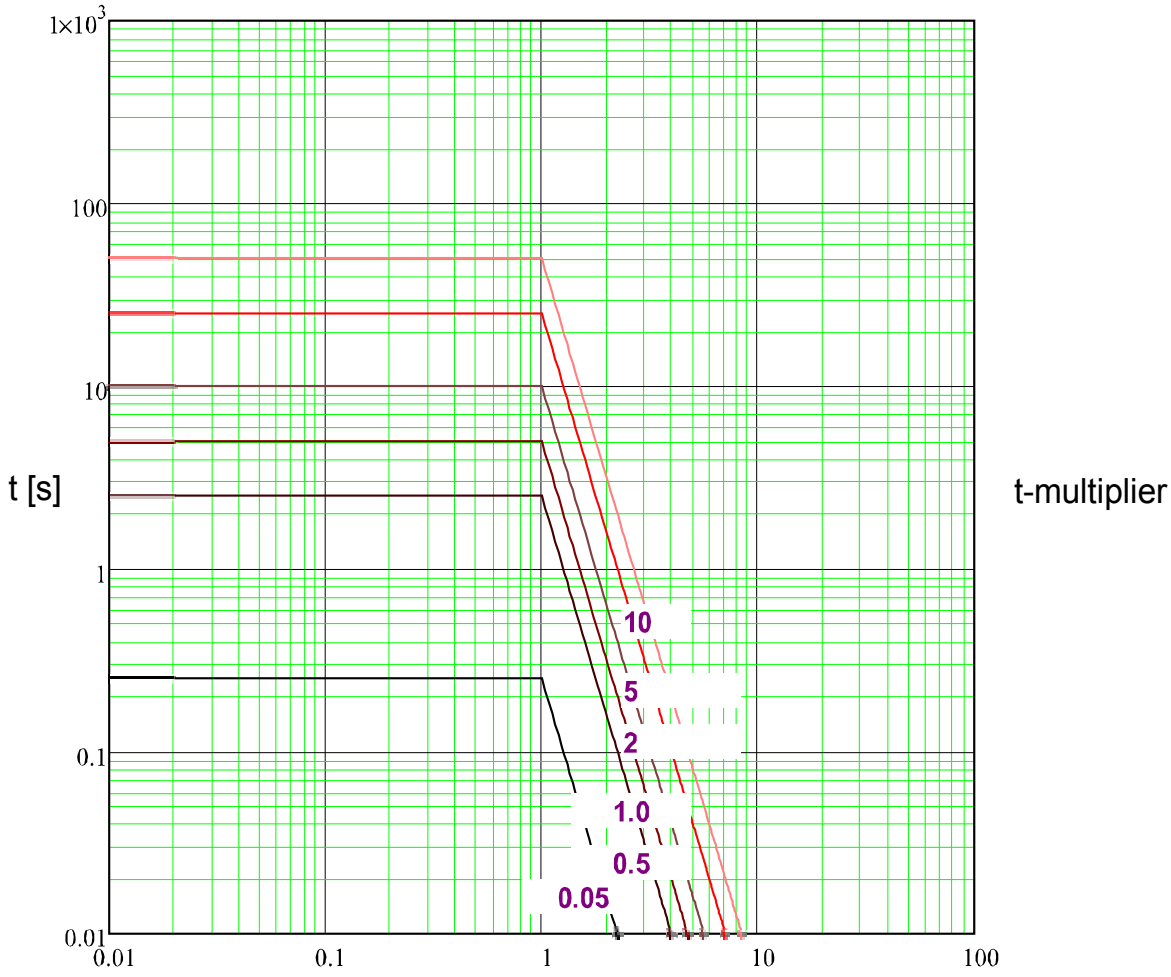
Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

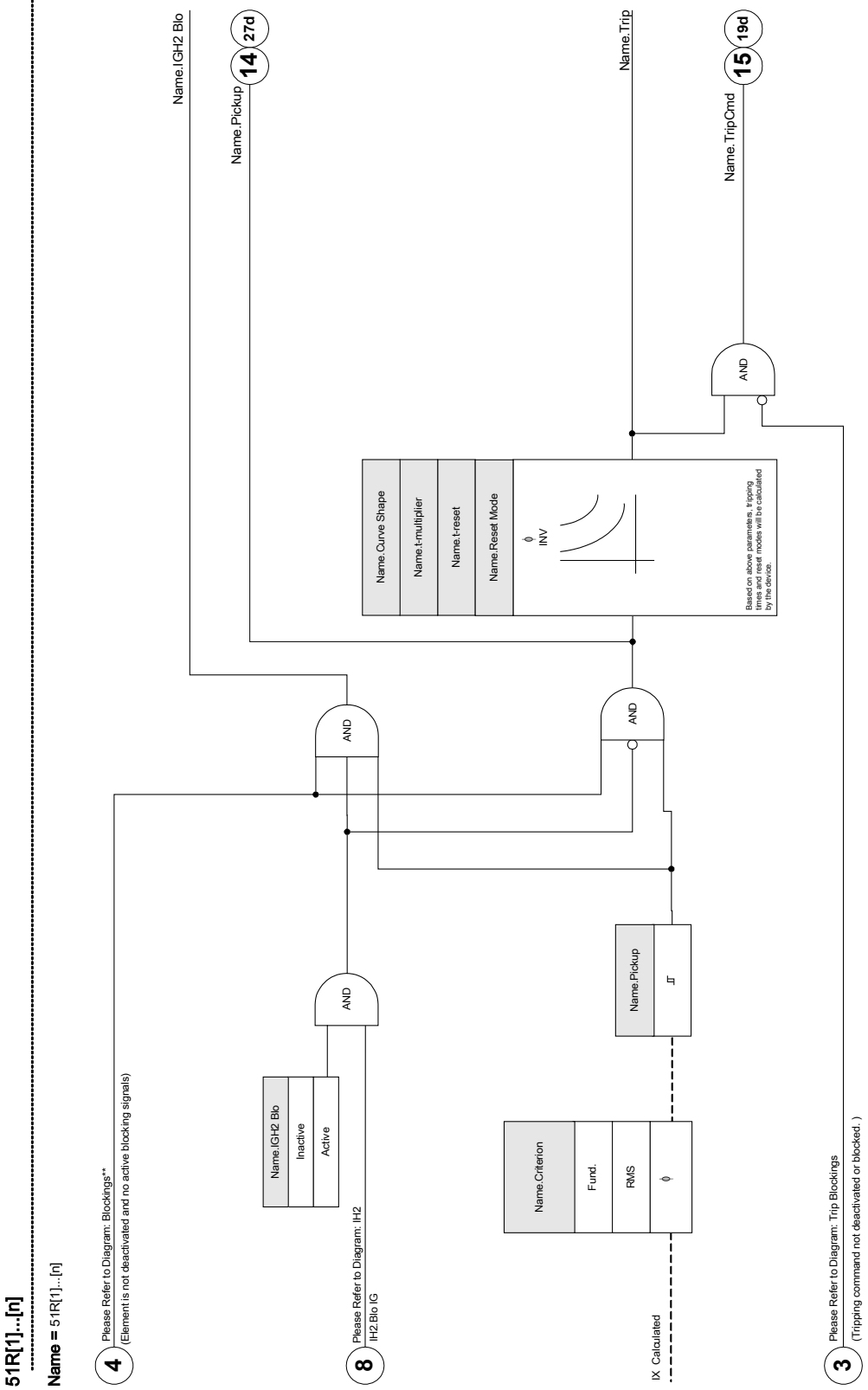
Reset

$$t = \left| \frac{5 * 1^2}{\left(\frac{IG}{IGnom}\right)^0} \right| * \text{t-multiplier [s]}$$

Trip

$$t = \frac{5 * 1^4}{\left(\frac{IG}{IGnom}\right)^4} * \text{t-multiplier [s]}$$




51R[1]...[n]
Name = 51R[1]...[n]
4
Please Refer to Diagram: Blockings**
(Element is not deactivated and no active blocking signals)
8
Please Refer to Diagram: IH2
IH2.Blo IG
IX Calculated
3
Please Refer to Diagram: Trip Blockings
(Tripping command not deactivated or blocked.)
Name.IGH2 Blo
Name.Pickup
14
27d
Name.Trip
Name.TripCmd
15
19d
AND
AND
AND
Name.IGH2 Blo
Inactive
Active
Name.Criterion
Fund.
RMS
Name.Pickup
Name.Curve Shape
Name.t-multiplier
Name.t-reset
Name.Reset Mode
INV
Based on above parameters, tripping time and reset modes will be calculated by the device.

Device Planning Parameters of the 51R Ground Fault Protection

Parameter	*Description*	*Options*	*Default*	*Menu Path*
Mode	Mode	Non-directional	Non-directional	[Device Planning]

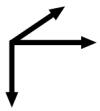
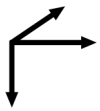
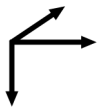
Global Protection Parameters of the 51R Ground Fault Protection

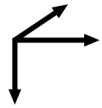
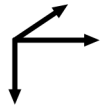
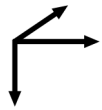
Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Winding Side	Winding Side	W1, W2	51R[1]: W1 51R[2]: W2	[Protection Para /Global Prot Para /I-Prot /51R[1]]
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /51R[1]]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /51R[1]]
ExBlo TripCmd	External blocking of the Trip Command of the module/the element, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /51R[1]]
Rvs Blo	Reverse Blocking, if Reverse Blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /51R[1]]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
AdaptSet 1	Assignment Adaptive Parameter 1	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /51R[1]]
AdaptSet 2	Assignment Adaptive Parameter 2	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /51R[1]]
AdaptSet 3	Assignment Adaptive Parameter 3	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /51R[1]]
AdaptSet 4	Assignment Adaptive Parameter 4	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /51R[1]]

Setting Group Parameters of the 51R Ground Fault Protection

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Function	Permanent activation or deactivation of module/element.	Inactive, Active	51R[1]: Inactive 51R[2]: Active	[Protection Para /<n> /I-Prot /51R[1]]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /51R[1]]
Rvs Blo Fc	Activate (allow) or inactivate (disallow) reverse blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/element are blocked that are parameterized "Rvs Blo Fc = active".	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /51R[1]]
Blo TripCmd	Permanent blocking of the Trip Command of the module/element.	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /51R[1]]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
ExBlo TripCmd Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo TripCmd Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /51R[1]]
Criterion	Measuring method: fundamental or rms	Fundamental, True RMS	True RMS	[Protection Para /<n> /I-Prot /51R[1]]
Pickup 	If the pickup value is exceeded, the module/element will be started.	0.01 - 20.00In	0.1In	[Protection Para /<n> /I-Prot /51R[1]]
Curve Shape 	Characteristic	IEC NINV, IEC VINV, IEC EINV, IEC LINV, ANSI MINV, ANSI VINV, ANSI EINV, Therm Flat, IT, I2T, I4T	ANSI MINV	[Protection Para /<n> /I-Prot /51R[1]]
t-multiplier 	Time multiplier/tripping characteristic factor	0.05 - 20.00	1	[Protection Para /<n> /I-Prot /51R[1]]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Reset Mode 	Reset Mode	Instantaneous, t-delay, Calculated	Calculated	[Protection Para /<n> /I-Prot /51R[1]]
t-reset 	Reset time for intermittent phase failures (INV characteristics only) Only available if:Reset Mode = t-delay	0.00 - 60.00s	0.00s	[Protection Para /<n> /I-Prot /51R[1]]
IH2 Blo 	Blocking the trip command, if an inrush is detected.	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /51R[1]]

51R Ground Fault Protection Input States

Name	*Description*	*Assignment Via*
ExBlo1-I	Module Input State: External Blocking1	[Protection Para /Global Prot Para /I-Prot /51R[1]]
ExBlo2-I	Module Input State: External Blocking2	[Protection Para /Global Prot Para /I-Prot /51R[1]]
ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command	[Protection Para /Global Prot Para /I-Prot /51R[1]]
Rvs Blo-I	Module Input State: Reverse Blocking	[Protection Para /Global Prot Para /I-Prot /51R[1]]
AdaptSet1-I	Module Input State: Adaptive Parameter1	[Protection Para /Global Prot Para /I-Prot /51R[1]]
AdaptSet2-I	Module Input State: Adaptive Parameter2	[Protection Para /Global Prot Para /I-Prot /51R[1]]
AdaptSet3-I	Module Input State: Adaptive Parameter3	[Protection Para /Global Prot Para /I-Prot /51R[1]]
AdaptSet4-I	Module Input State: Adaptive Parameter4	[Protection Para /Global Prot Para /I-Prot /51R[1]]

51R Ground Fault Protection Signals (Output States)

Name	*Description*
Active	Signal: Active
ExBlo	Signal: External Blocking
Rvs Blo	Signal: Reverse Blocking
Blo TripCmd	Signal: Trip Command blocked
ExBlo TripCmd	Signal: External Blocking of the Trip Command
Pickup	Signal: Pickup IX or IR
Trip	Signal: Trip
TripCmd	Signal: Trip Command
IGH2 Blo	Signal: Blocked by IH2
Active AdaptSet	Active Adaptive Parameter
DefaultSet	Signal: Default Parameter Set
AdaptSet 1	Signal: Adaptive Parameter 1
AdaptSet 2	Signal: Adaptive Parameter 2
AdaptSet 3	Signal: Adaptive Parameter 3
AdaptSet 4	Signal: Adaptive Parameter 4

Commissioning: Ground Fault Protection – Non-directional [ANSI 51R]

Please test the non-directional ground overcurrent analog to the non-directional phase overcurrent protection.

Zone Interlocking

Elements
ZI[1] ,ZI[2]

Principle – General Use

The purpose of zone interlocking is to speed up tripping for some faults without sacrificing the coordination of the system and interjecting nuisance trips into the system. Zone interlocking devices can communicate across distribution zones to determine whether or not a device sees a fault condition.

Zone interlocking is a communication scheme used with breakers and protective relays to improve the level of protection in a power distribution system. This is achieved through communication between the downstream and upstream devices in a power system. The zones are classified by their location downstream of the main circuit protective device which is generally defined as Zone 1.

By definition, a selectively coordinated system is one where by adjusting the trip unit pickup and time delay settings, the breaker closest to the fault trips first. The upstream breaker serves two functions: (1) back-up protection to the downstream breaker and (2) protection of the conductors between the upstream and downstream breakers.

For faults which occur on the conductors between the upstream and downstream breakers, it is ideal for the upstream breaker to trip with no time delay. This is the feature provided by Zone Selective Interlocking.

The zone interlocking information can be transferred to or received from other compatible zone interlocking devices by means of suitable communication cables. With its 3-wire scheme this terminal block implies, however, only a combined connection for phase and ground fault input and output is possible.

WARNING **Systems containing multiple sources, or where the direction of power flow varies, require special considerations, or may not be suitable for this feature.**

NOTICE **The breaker failure pickup signal »BF.PICKUP« is implicitly connected to zone interlocking, so that NO zone interlock output signal can be sent to the upstream device if a breaker failure on a downstream device is detected.**

Description of the Functions and Features

- Configurable protection functions to initiate the zone interlocking OUTPUT signal (start functions).
- Remove zone interlocking OUTPUT signal immediately after detection of a breaker failure.
- Reset time (about ten cycles - settable) to interrupt OUTPUT signal for durable trip signal.
- Small trip delay (about three cycles – settable) to wait for downstream devices interlocking signals.
- Zone interlocking trip signal only possible by absence of zone interlocking INPUT signals.
- Configurable zone interlocking trip functions (protective functions serve as zone interlocking trip functions).
- Zone interlocking trip function pickup and tripping characteristic adaption using adaptive settings controlled by the zone interlocking input signals.

Device Planning Parameters of the Zone Interlocking

Parameter	*Description*	*Options*	*Default*	*Menu Path*
Mode	Mode	Use	Use	[Device Planning]

Global Protection Parameters of the Zone Interlocking

In the global parameter menu for zone interlocking 2, external blocking inputs (»*Ex Block1/Ex Block2«),* just like the other protection modules, can be assigned to two input functions, so that the zone interlocking function can be blocked by the assigned functions.

Via an external input signal, the zone interlocking can also be blocked if the parameter »*ExtBlockTripCMD«* is assigned.

NOTICE

Breaker Failure Pickup flag BF.Pickup is implicitly connected to zone interlocking, so that NO zone interlock output signal can be sent to the upstream device if a breaker failure on downstream device is detected.

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /ZI /ZI[1]]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /ZI /ZI[1]]
ExBlo TripCmd	External blocking of the Trip Command of the module/the element, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /ZI /ZI[1]]

Setting Group Parameters of the Zone Interlocking

The zone interlocking Setting Group Parameters consists of three groups of setting to configure the zone interlocking module to adapt to various application philosophies accordingly:

- General: This group comprises the settings used to control the general usage of the zone interlocking module.

- OUTPUT: What should be assigned to the Zone Out?
  - Phase,
  - Ground, or
- - Both.

  The OUTPUT group comprises the settings to configure the zone interlocking output logic. If the zone interlocking application is used to a downstream device, the settings in OUTPUT group should be programmed accordingly. If the zone interlocking application is only used for an upstream device (main breaker or Zone 1), the setting ZoneInterlockOut within the OUTPUT group should be disabled.

- TRIP: Activate the Zone Trip.

  The TRIP group comprises the settings used to configure the zone interlocking TRIP logic. If the zone interlocking application is applied to an upstream device, (main breaker or Zone 1), the settings in the TRIP group should be programmed accordingly. If the zone interlocking application is only used for a downstream device (feeder breaker or Zone 2), the setting ZoneInterlockTript in TRIP group should be disabled.

Setting the above mentioned setting groups accordingly the zone interlocking module can be configured as:

- Downstream device application (using only OUTPUT logic);,

- Upstream device application (using only TRIP logic); or

- Midstream device application (using both OUTPUT and TRIP logics together).

The following menu and tables show the detailed information about the settings.

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Function	Permanent activation or deactivation of module/element.	Inactive, Active	Inactive	[Protection Para /<n> /ZI /ZI[1] /General Settings]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /ZI /ZI[1] /General Settings]
Blo TripCmd	Permanent blocking of the Trip Command of the module/element.	Inactive, Active	Inactive	[Protection Para /<n> /ZI /ZI[1] /General Settings]
ExBlo TripCmd Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo TripCmd Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /ZI /ZI[1] /General Settings]
ZI OUT Fc	Zone Interlocking Out activate (allow) / inactivate (disallow)	Inactive, Active	Inactive	[Protection Para /<n> /ZI /ZI[1] /Zone Out]
Fault Type	Fault Type	Phase, Ground, Both	Phase	[Protection Para /<n> /ZI /ZI[1] /Zone Out]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Trip	Signal: Zone Interlocking Trip	Inactive, Active	Inactive	[Protection Para /<n> /ZI /ZI[1] /Zone Trip]
Fault Type	Fault Type	Phase, Ground, Both	Phase	[Protection Para /<n> /ZI /ZI[1] /Zone Trip]

Zone Interlocking Output Logic [X2]

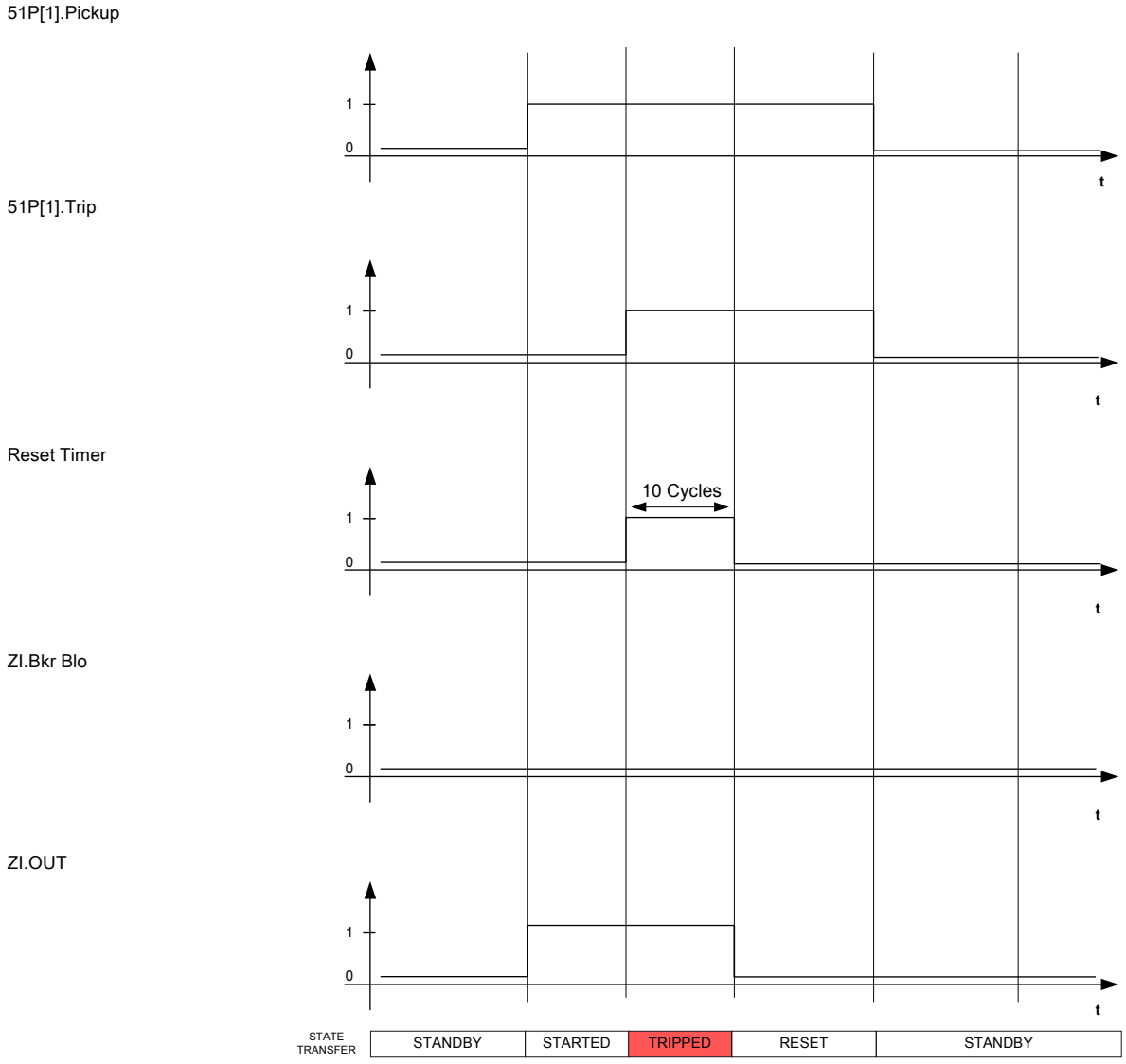
The following current protective function elements serve as the Phase Zone Interlock OUTPUT start functions:

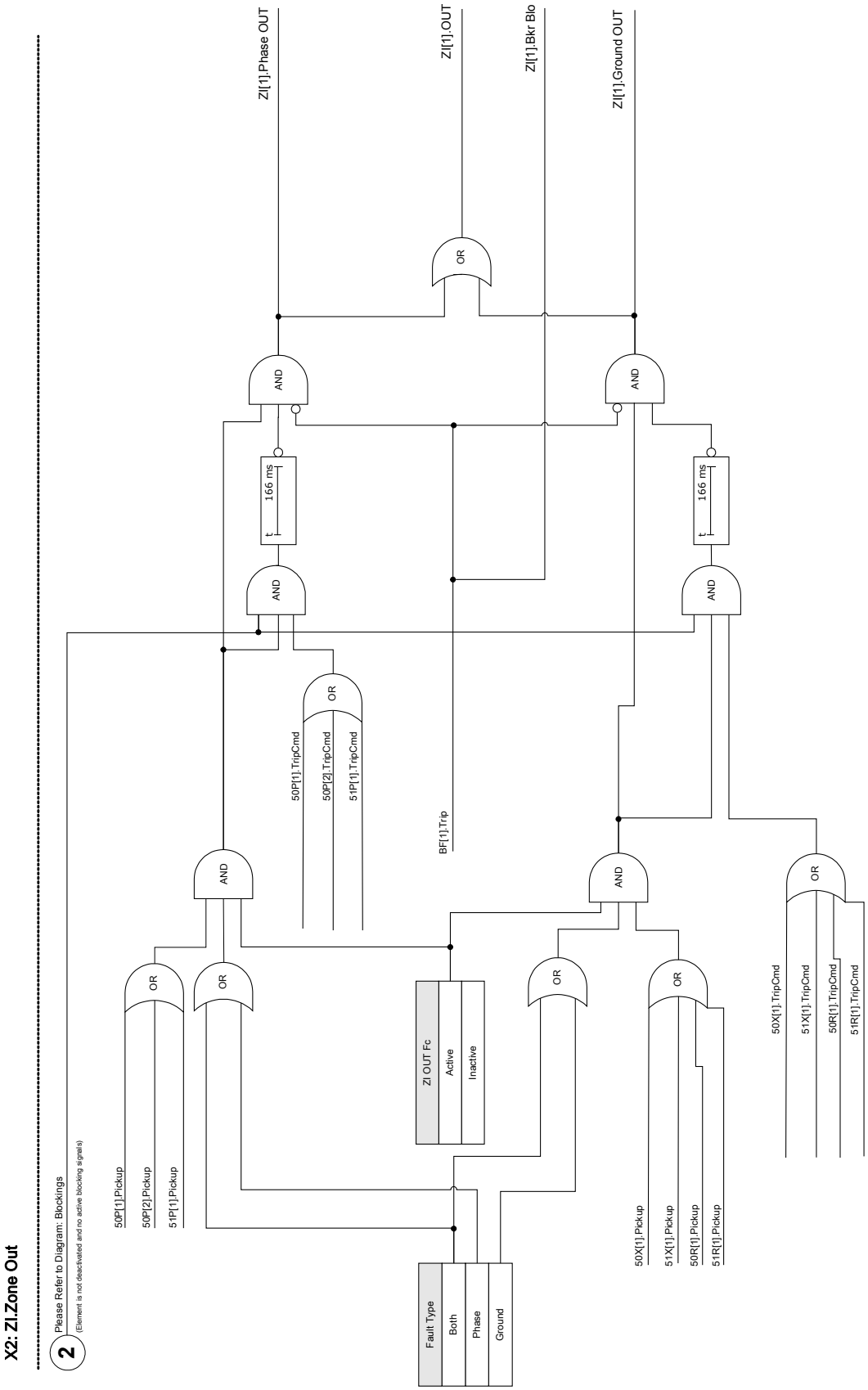
- 51P[1];
- 50P[1]; and
- 50P[2].

The following current protective function serves as the Ground Zone Interlock OUTPUT start functions:

- 51X[1];
- 50X[1];
- 51R[1]; and
- 50R[1].

Zone Interlocking OUTPUT Logic Timing




X2: ZI.Zone Out
2
Please Refer to Diagram: Blockings
(Element is not deactivated and no active blocking signals)
Z[1].Phase OUT
Z[1].OUT
Z[1].Bkr Blo
Z[1].Ground OUT
OR
AND
166 ms
t
50P[1].TripCmd
50P[2].TripCmd
51P[1].TripCmd
BF[1].Trip
50P[1].Pickup
50P[2].Pickup
51P[1].Pickup
ZI OUT Fc
Active
Inactive
Fault Type
Both
Phase
Ground
50X[1].Pickup
51X[1].Pickup
50R[1].Pickup
51R[1].Pickup
50X[1].TripCmd
51X[1].TripCmd
50R[1].TripCmd
51R[1].TripCmd

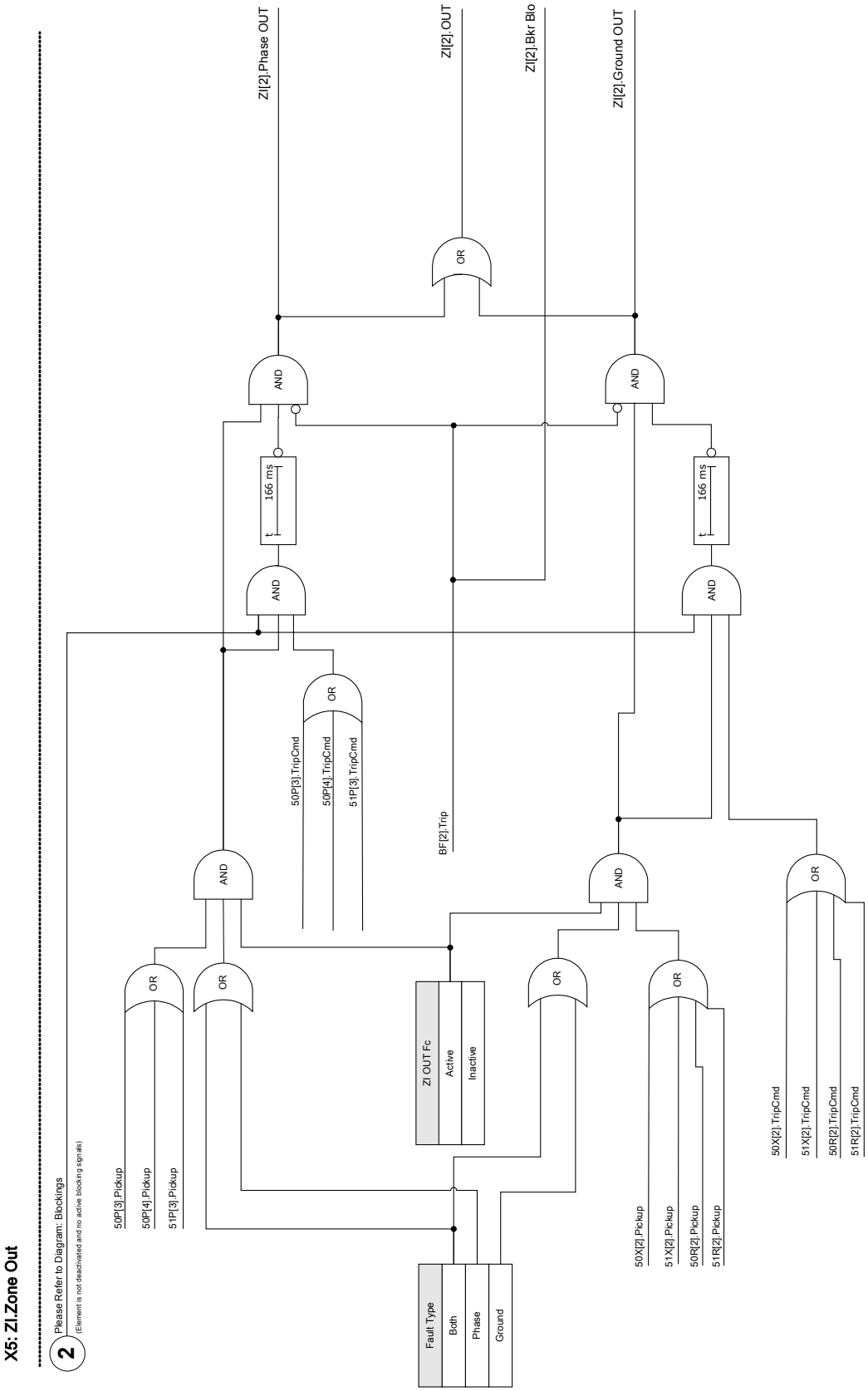
Zone Interlocking Output Logic [X5]

The following current protective function elements serve as the Phase Zone Interlock OUTPUT start functions:

- 51P[3];
- 50P[3]; and
- 50P[4].

The following current protective function serves as the Ground Zone Interlock OUTPUT start functions:

- 51X[2];
- 50X[2];
- 51R[2]; and
- 50R[2].


X5: ZI.Zone Out
2
Please Refer to Diagram: Blockings
(Element is not deactivated and no active blocking signals)
50P[3].Pickup
50P[4].Pickup
51P[3].Pickup
OR
OR
AND
50P[3].TripCmd
50P[4].TripCmd
51P[3].TripCmd
OR
AND
166 ms
t
ZI OUT Fc
Active
Inactive
BF[2].Trip
OR
AND
166 ms
t
OR
OR
Fault Type
Both
Phase
Ground
50X[2].Pickup
51X[2].Pickup
50R[2].Pickup
51R[2].Pickup
AND
OR
50X[2].TripCmd
51X[2].TripCmd
50R[2].TripCmd
51R[2].TripCmd
ZI[2].Phase OUT
ZI[2].OUT
ZI[2].Bkr Blo
ZI[2].Ground OUT

Zone Interlocking Trip Logic [X2]

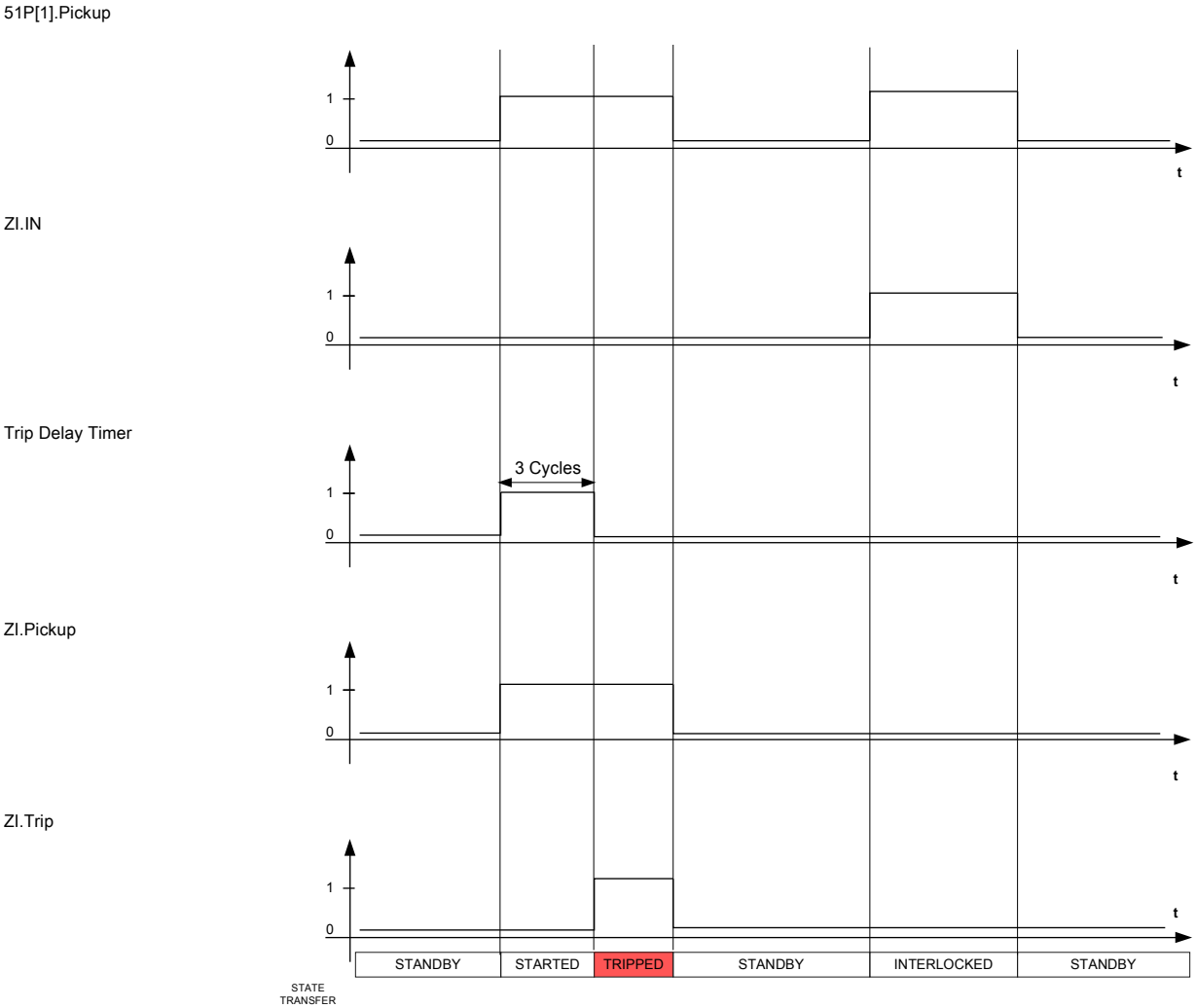
The following overcurrent protection elements trigger Phase Zone-Interlock trip functions:

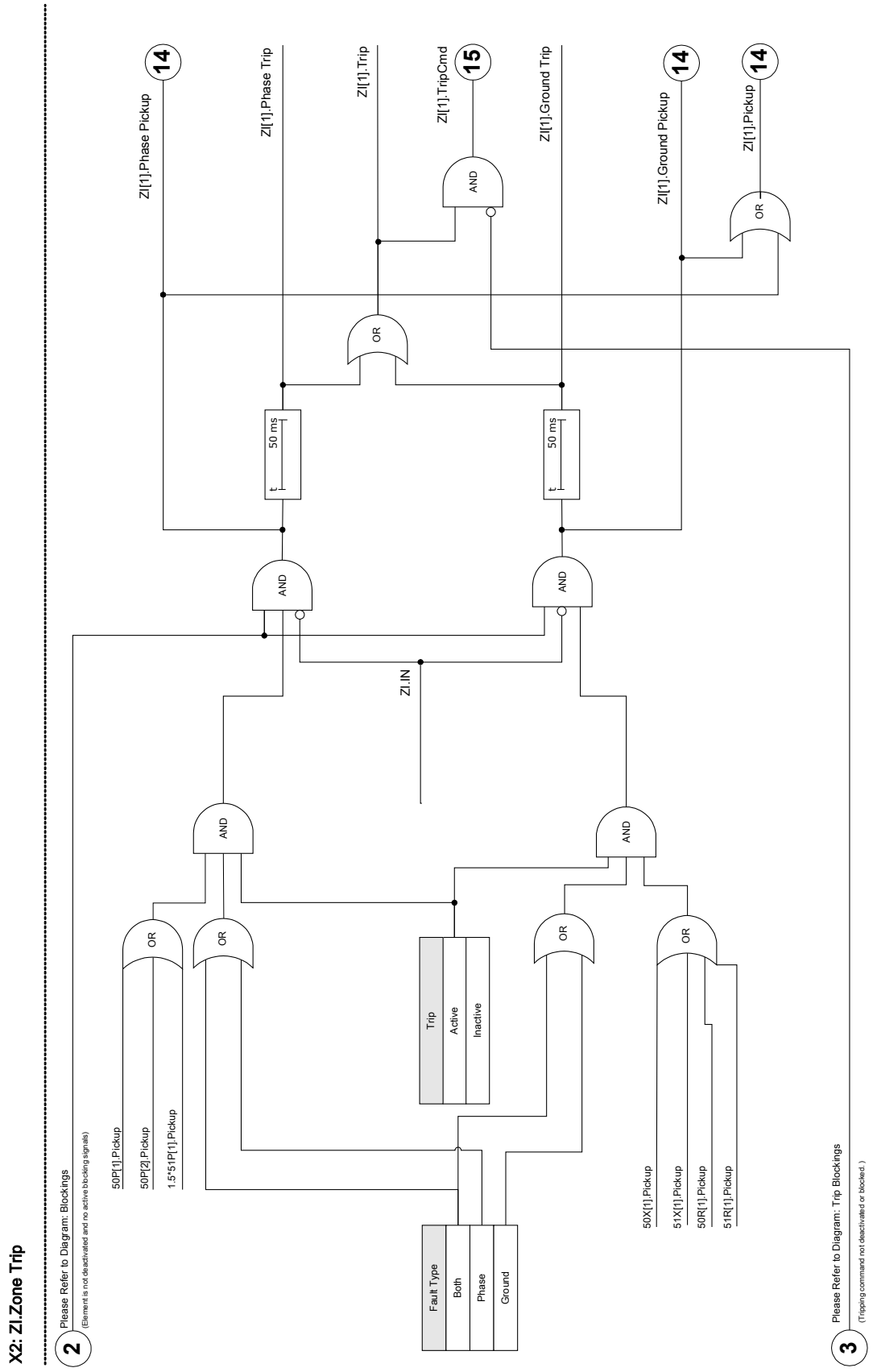
- 1.5 * 51P[1];
- 50P[1]; and
- 50P[2].

The following overcurrent protection elements trigger Ground Zone Interlock trip functions:

- 51X[1];
- 50X[1];
- 51R[1]; and
- 50R[1].

Zone Interlocking TRIP Logic Timing




X2: ZI.Zone Trip
2
Please Refer to Diagram: Blockings
(Element is not deactivated and no active blocking signals)
50P[1].Pickup
50P[2].Pickup
1.5*51P[1].Pickup
OR
OR
AND
ZI.IN
Fault Type
Both
Phase
Ground
Trip
Active
Inactive
AND
AND
50 ms
50 ms
OR
OR
OR
OR
50X[1].Pickup
51X[1].Pickup
50R[1].Pickup
51R[1].Pickup
ZI[1].Phase Pickup
14
ZI[1].Phase Trip
ZI[1].Trip
ZI[1].TripCmd
15
AND
ZI[1].Ground Trip
ZI[1].Ground Pickup
14
ZI[1].Pickup
14
OR
3
Please Refer to Diagram: Trip Blockings
(Tripping command not deactivated or blocked.)

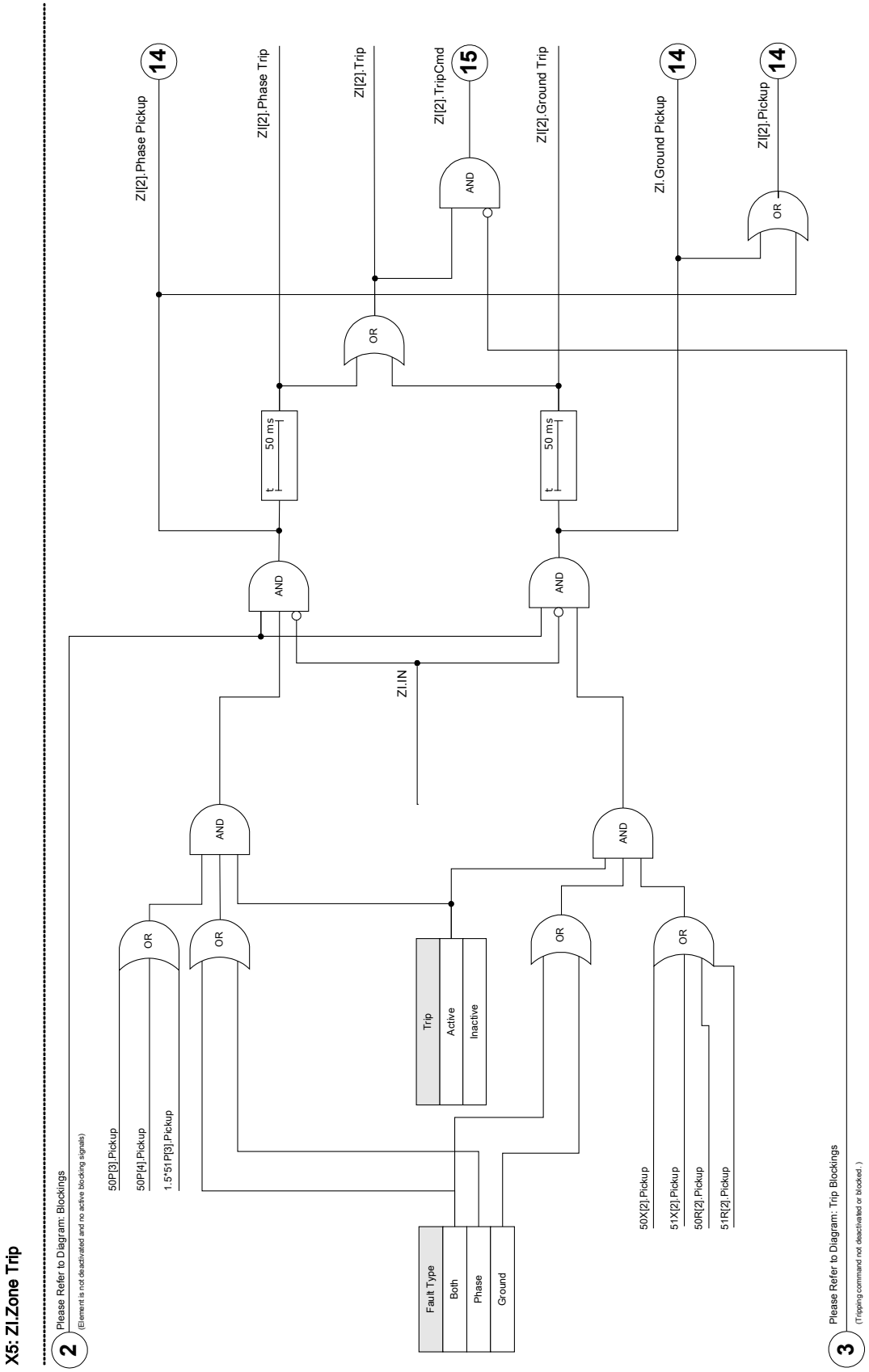
Zone Interlocking Trip Logic [X5]

The following protection elements trigger Phase Zone Interlock trip functions:

- 1.5 * 51P[3];
- 50P[3]; and
- 50P[4].

The following overcurrent protection elements trigger Ground Zone Interlock trip functions:

- 51X[2];
- 50X[2];
- 51R[2]; and
- 50R[2].


X5: ZI.Zone Trip
2
Please Refer to Diagram: Blockings
(Element is not deactivated and no active blocking signals)
50P[3].Pickup
50P[4].Pickup
1.5*51P[3].Pickup
OR
OR
AND
ZI.IN
50 ms
t
AND
OR
Trip
Active
Inactive
Fault Type
Both
Phase
Ground
14
ZI[2].Phase Pickup
ZI[2].Phase Trip
ZI[2].Trip
15
ZI[2].TripCmd
AND
ZI[2].Ground Trip
50 ms
t
AND
OR
OR
50X[2].Pickup
51X[2].Pickup
50R[2].Pickup
51R[2].Pickup
14
ZI.Ground Pickup
14
ZI[2].Pickup
OR
3
Please Refer to Diagram: Trip Blockings
(Tripping command not deactivated or blocked.)

Zone Interlocking Input States

Name	*Description*	*Assignment Via*
ExBlo1-I	Module Input State: External Blocking1	[Protection Para /Global Prot Para /ZI /ZI[1]]
ExBlo2-I	Module Input State: External Blocking2	[Protection Para /Global Prot Para /ZI /ZI[1]]
ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command	[Protection Para /Global Prot Para /ZI /ZI[1]]
Bkr Blo-I	Signal: Blocked by Breaker Failure	[]

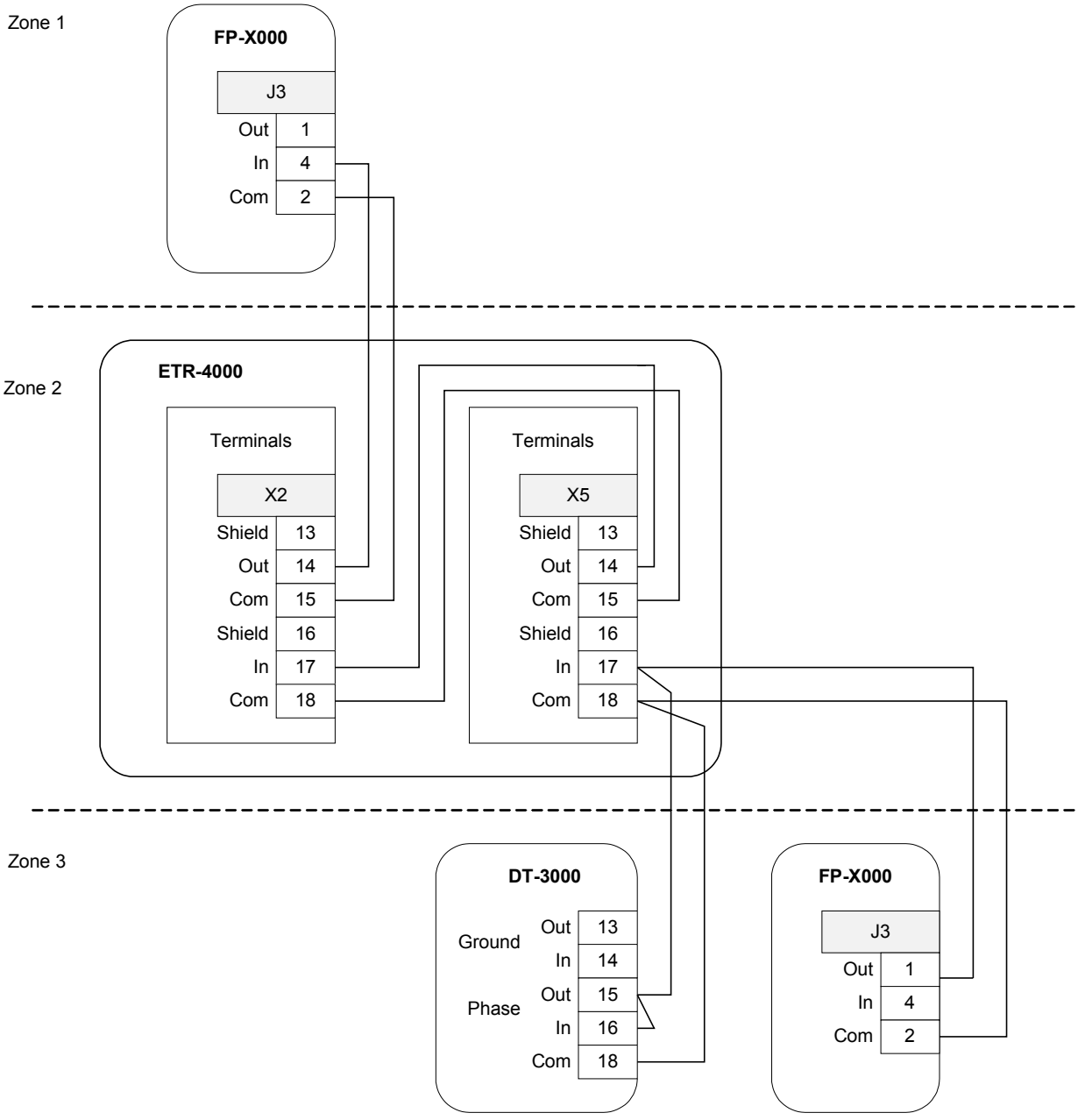
Zone Interlocking Signals (Output States)

Name	*Description*
Active	Signal: Active
ExBlo	Signal: External Blocking
Blo TripCmd	Signal: Trip Command blocked
ExBlo TripCmd	Signal: External Blocking of the Trip Command
Bkr Blo	Signal: Blocked by Breaker Failure
Phase Pickup	Signal: Zone Interlocking Phase Pickup
Phase Trip	Signal: Zone Interlocking Phase Trip
Ground Pickup	Signal: Zone Interlocking Ground Pickup
Ground Trip	Signal: Zone Interlocking Ground Trip
Pickup	Signal: Pickup Zone Interlocking
Trip	Signal: Zone Interlocking Trip
TripCmd	Signal: Zone Interlocking Trip Command
Phase OUT	Signal: Zone Interlocking Phase OUT
Ground OUT	Signal: Zone Interlocking Ground OUT
OUT	Signal: Zone Interlocking OUT
IN	Signal: Zone Interlocking IN

Zone Interlocking Wiring

NOTICE **The ZI Outputs are for use with connection to electronic inputs only.**

The zone interlocking connection between relays is done by means of a twisted shielded cable. Downstream zone interlock outputs may be paralleled from up to ten devices (FP-5000 or DT-3000 or a combination of both) for connection to upstream zone interlocked relays.



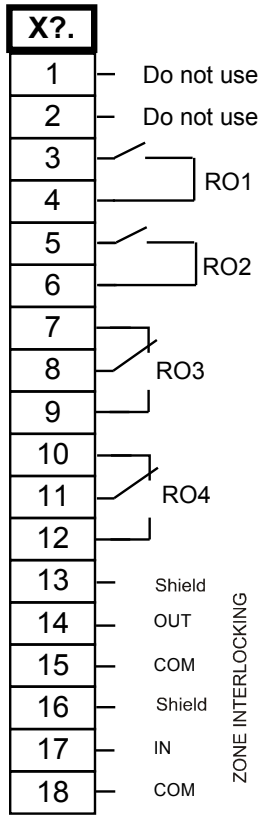
Hardware Terminals for Zone Interlocking

By means of the zone interlocking terminals, the device can be connected to other Eaton protective devices such as an FP5000, DT3000, etc.

As an upstream device, the terminals - Phase/Ground IN should be connected to the OUT terminals of up to ten downstream device(s) by means of a dedicated cable wired in parallel. As a downstream device, the terminals - Phase/Ground OUT should be connected to the IN terminals of an upstream device by means of a dedicated cable.

The zone interlocking connection between relays is done by means of a twisted shielded cable. Downstream zone interlock outputs may be paralleled from up to ten devices (FP-5000 or DT-3000 or a combination of both) for connection.

Terminal Marking X2, X5 *for Device: ETR-4000*



49 - Thermal Replica Protection Module [49]

49

One thermal overload protection function is provided for tripping and alarming based on the thermal model using the maximum phase current (transformer only - from either winding 1 or winding 2) based on the User's choice.

NOTICE **This thermal overload protection function applies to transformers ONLY.**

The thermal model, with preload current taken into account, is in compliance with IEC255-8 (VDE 435 T301). The thermal tripping limit is determined by the so called overload factor K multiplying the maximum permissible continuous phase current Ib. Ib is also referred to as the base current or rated current, which can be found from the transformer (or other equipment to be protected) name plate. The overload factor K must be determined based on the transformer type and its cooling method (or other equipment to be protected). The transformer with natural cooling may have less tolerance on overload while other types of transformer with forced cooling (oil or air) may be allowed to run under substantial overload for a relatively long time.

The warming and cooling process of the thermal replica is dictated by the warming, cooling constants τ (»*t-warm*«, »*t-cool«)*. *t-warm*« is the time in which the temperature of the operating equipment to be protected has reached 63% of the stationary operating temperature under rated load current after switching on. »t-cool«is the time in which the temperature of the operating equipment to be protected has dropped 63% of the stationary operating temperature when switching off from the rated load condition. These time constants may be found in the data sheet of the transformer or may be derived from test reports.

The tripping time is determined by the tripping time characteristic according to the thermal model. The alarm threshold is defined as a percentage of the thermal tripping limit.

$$t = t\text{-warm} \ln\left(\frac{I^2 - Ip^2}{I^2 - (K*Ib)^2}\right)$$

Legend:

t = Tripping delay

t-warm = Warming-up time constant

t-cool = Cooling time constant

Ib = Base Current: Maximum permissible thermal continuous current.

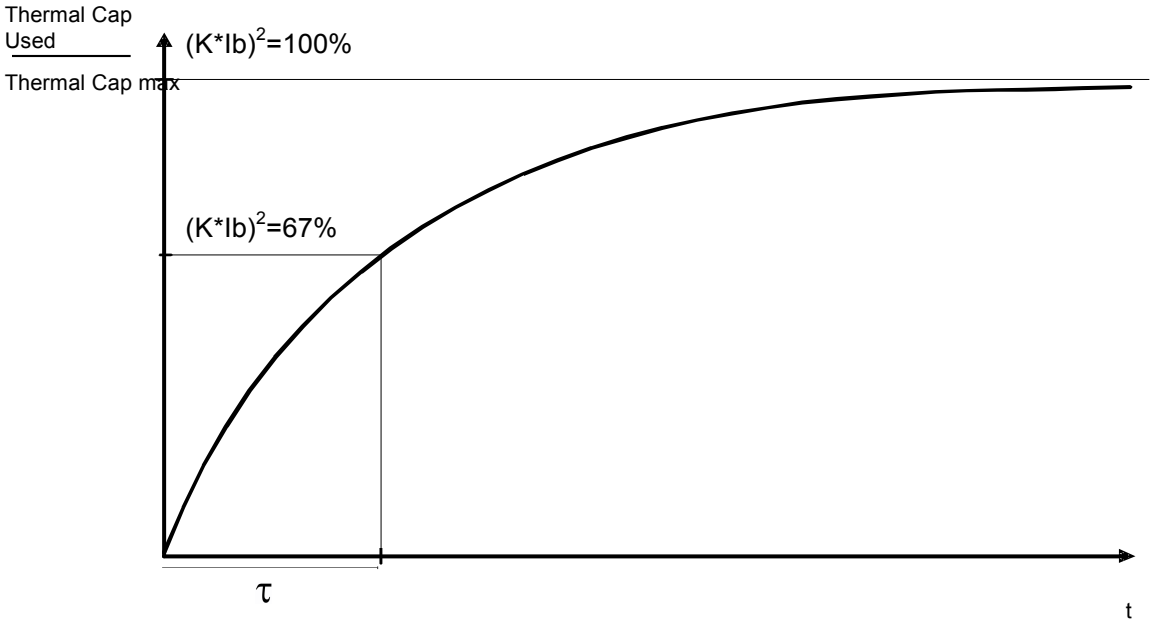
K = Overload Factor: The maximum thermal limit is defined as k*IB, the product of the overload factor and the basic current.

I = Measured current (x In)

Ip = Preload Current

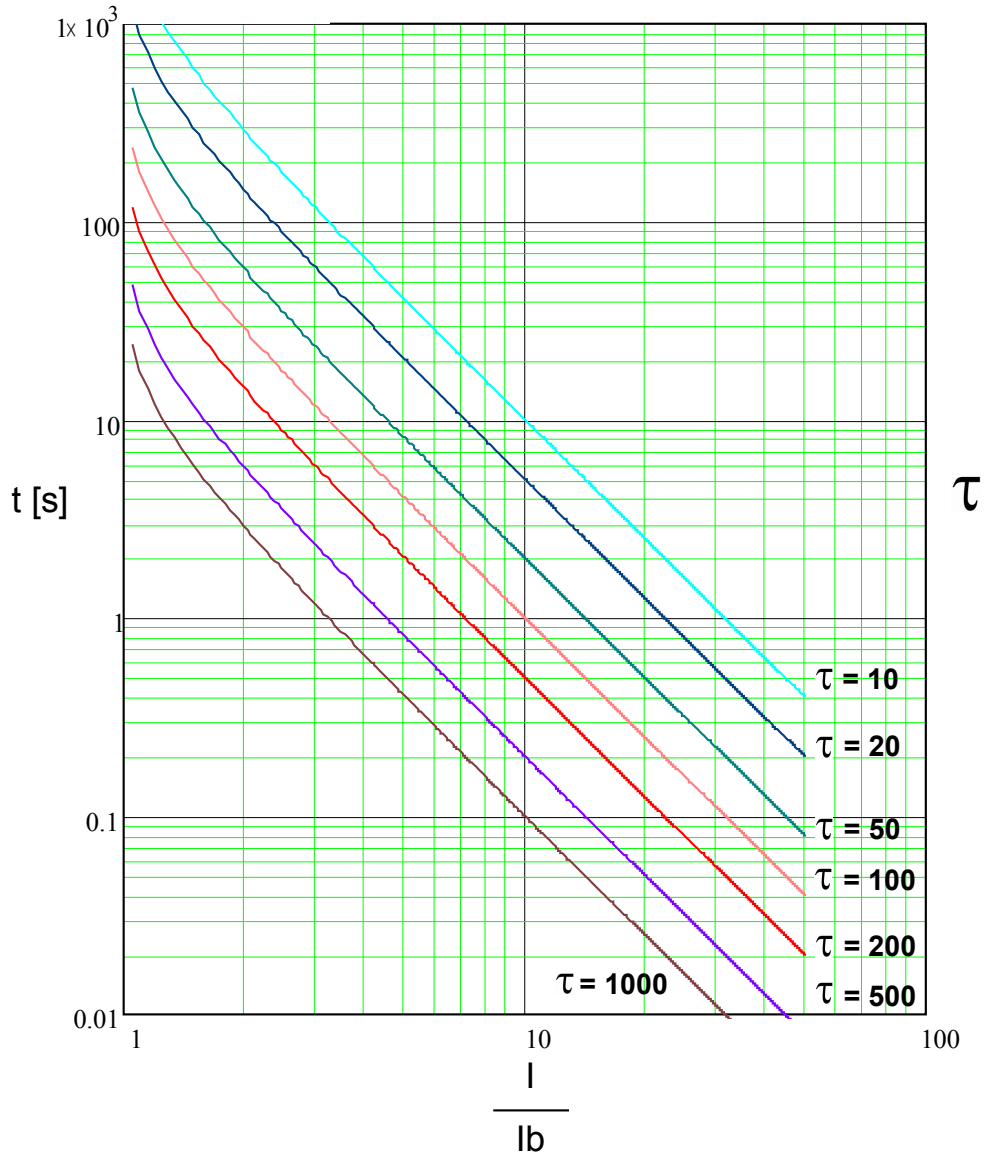
Tripping characteristic with initial load:

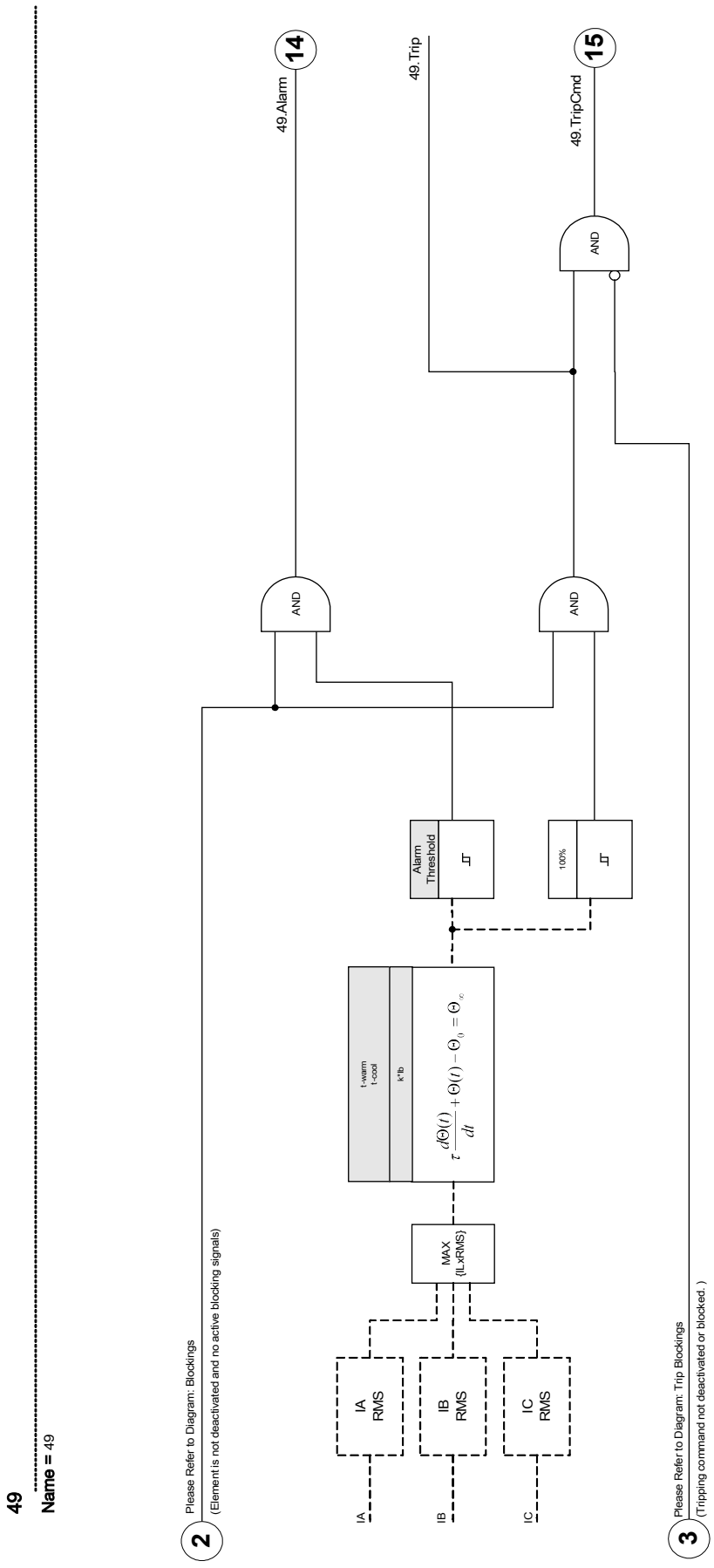
Characteristic with complete memory function - the heating caused by the current before the overload happens is taken into account for the thermal replica of the electrical equipment to be protected.



NOTICE **The curves below are valid for Ip=0 and K=1.**

Thermal Overload Characteristic Example – IEC Trip Characteristic for Overload Protection




49
Name = 49
2
Please Refer to Diagram: Blockings
(Element is not deactivated and no active blocking signals)
IA
IB
IC
IA RMS
IB RMS
IC RMS
MAX (ILxRMS)
t-warm
t-cool
k*Ib
$\tau \frac{d\Theta(t)}{dt} + \Theta(t) - \Theta_{t} = \Theta_{\infty}$
Alarm Threshold
100%
AND
AND
49.Alarm
49.Trip
49.TripCmd
AND
14
15
3
Please Refer to Diagram: Trip Blockings
(Tripping command not deactivated or blocked.)

Direct Commands of the Thermal Overload Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Reset	Reset the Thermal Replica	Inactive, Active	Inactive	[Operation /Reset]

Device Planning Parameters of the Thermal Overload Module

Parameter	*Description*	*Options*	*Default*	*Menu Path*
Mode	Mode	Do not use, Use	Use	[Device Planning]

Global Protection Parameters of the Thermal Overload Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Winding Side	Winding Side	W1, W2	W1	[Protection Para /Global Prot Para /I-Prot /49]
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /49]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /49]
ExBlo TripCmd	External blocking of the Trip Command of the module/the element, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /49]

Setting Group Parameters of the Thermal Overload Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Function	Permanent activation or deactivation of module/element.	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /49]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /49]
Blo TripCmd	Permanent blocking of the Trip Command of the module/element.	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /49]
ExBlo TripCmd Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo TripCmd Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /49]
Ib	Base Current: Maximum permissible thermal continuous current.	0.01 - 4.00In	1.00In	[Protection Para /<n> /I-Prot /49]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
K	Overload Factor: The maximum thermal limit is defined as k*IB, the product of the overload factor and the basic current.	0.80 - 1.20	1.00	[Protection Para /<n> /I-Prot /49]
Alarm Threshold	Alarm Threshold	50 - 100%	80%	[Protection Para /<n> /I-Prot /49]
τ-warm	Warming-up time constant	1 - 60000s	10s	[Protection Para /<n> /I-Prot /49]
τ-cool	Cooling time constant	1 - 60000s	10s	[Protection Para /<n> /I-Prot /49]

Thermal Overload Module Input States

Name	*Description*	*Assignment Via*
ExBlo1-I	Module Input State: External Blocking1	[Protection Para /Global Prot Para /I-Prot /49]
ExBlo2-I	Module Input State: External Blocking2	[Protection Para /Global Prot Para /I-Prot /49]
ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command	[Protection Para /Global Prot Para /I-Prot /49]

Signals of the Thermal Overload Module (Output States)

Name	*Description*
Active	Signal: Active
ExBlo	Signal: External Blocking
Blo TripCmd	Signal: Trip Command blocked
ExBlo TripCmd	Signal: External Blocking of the Trip Command
Alarm	Signal: Alarm Thermal Overload
Trip	Signal: Trip
TripCmd	Signal: Trip Command
Reset Thermal Cap	Signal: Resetting Thermal Replica

Thermal Overload Module Values

Value	*Description*	*Menu Path*
Thermal Cap Used	Measured value: Thermal Capacity Used	[Operation /Measured Values /49]
Time To Trip	Measured value (calculated/measured): Remaining time until the thermal overload module will trip	[Operation /Measured Values /49]

Thermal Overload Module Statistics

Value	*Description*	*Menu Path*
Thermal Cap max	Thermal Capacity maximum value	[Operation /Statistics /49]
Thermal Cap avg	Thermal Capacity average value	[Operation /Statistics /49]
Thermal Cap min	Thermal Capacity minimum value	[Operation /Statistics /49]

Commissioning: Thermal Replica [49]

Object to be tested:
Protective function *ThR*

Necessary means:
- Three-phase current source
- Timer

Procedure:
Calculate the tripping time based on the formula provided.

NOTICE **The warming-up time constant has to be known to guarantee optimal protection.**

$$t = t\text{-warm } \ln\left(\frac{I^2 - Ip^2}{I^2 - (K*Ib)^2}\right)$$

Legend:

t = Tripping delay

t-warm = Warming-up time constant

t-cool = Cooling time constant

Ib = Base Current: Maximum permissible thermal continuous current.

K = Overload Factor: The maximum thermal limit is defined as k*IB, the product of the overload factor and the basic current.

I = Measured current (x In)

Ip = Preload Current

Testing the threshold values:
Apply the current on which the mathematical calculation was based.

Testing the trip delay:

NOTICE **The thermal capacity should be zero before the test is started (see »Measuring Values«).**

For testing the trip delay, a timer is to be connected to the contact of the associated trip relay. Apply the current on which the mathematical calculation was based. The timer is started as soon as the current is applied and it is stopped when the relay trips.

Successful test result:
The calculated tripping time and the drop-out ratio comply with the measured values. For permissible deviations/tolerances, please see the Technical Data section.

IH2 Module

Elements
IH2[1] ,IH2[2]

Principle – General Use

The magnetizing current may have a significant amount of harmonics when energizing an unloaded transformer, in particular, 2nd harmonics. The IH2 module (harmonic blocking) uses a percentage of the 2nd harmonics over its fundamental to generate general or phase-based blocking signals for other protection functions use.

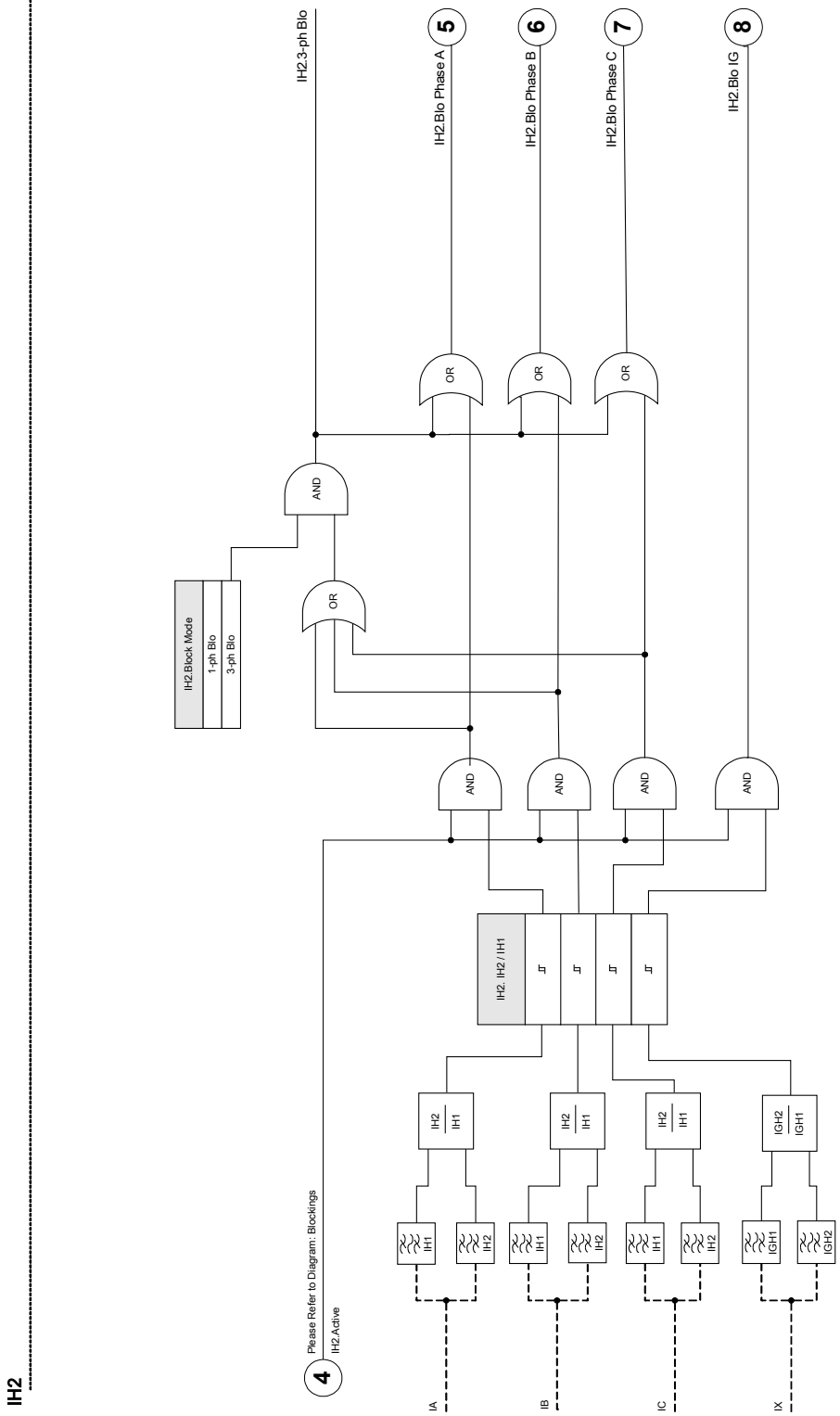
There are two blocking modes.

•If 1-phase block mode is selected, the module will only generate the blocking signals for those phases whose 2nd harmonic percentages exceed their threshold respectively.

•If 3-phase mode is selected, the module will generate the blocking signals for all three phases as long as the 2nd harmonic percentage in one or more phases exceeds their threshold.

Note that the 2nd harmonic percentage in IX shares the same threshold as other phases but it will not be controlled by the blocking mode.

IH2


IH2.3-ph Blo
IH2.Blo Phase A
IH2.Blo Phase B
IH2.Blo Phase C
IH2.Blo IG
5
6
7
8
OR
OR
OR
AND
IH2.Block Mode
1-ph Blo
3-ph Blo
OR
AND
AND
AND
AND
IH2. IH2 / IH1
IH2/IH1
IGH2/IGH1
IH1
IH2
IGH1
IGH2
Please Refer to Diagram: Blockings
IH2.Active
4
IA
IB
IC
IX

Device Planning Parameters of the IH2 Module

Parameter	*Description*	*Options*	*Default*	*Menu Path*
Mode	Mode	Do not use, Use	Use	[Device Planning]

Global Protection Parameters of the IH2 module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Winding Side	Winding Side	IH2[1]: W1 IH2[2]: W2	IH2[1]: W1 IH2[2]: W2	[Protection Para /Global Prot Para /I-Prot /IH2[1]]
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /IH2[1]]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /IH2[1]]

Setting Group Parameters of the IH2 Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Function	Permanent activation or deactivation of module/element.	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /IH2[1]]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /IH2[1]]
IH2 / IH1	Maximum permissible percentage of the 2nd harmonic over the fundamental.	10 - 40%	15%	[Protection Para /<n> /I-Prot /IH2[1]]
Block Mode	1-ph Blo: If an inrush is detected in one phase, the corresponding phase of those modules will be blocked, where inrush blocking is set to active./3-ph Blo: If an inrush is detected in at least one phase, all three phases of those modules where inrush blocking is set to active will be blocked (cross blocking).	1-ph Blo, 3-ph Blo	1-ph Blo	[Protection Para /<n> /I-Prot /IH2[1]]

Inrush Module IH2 States

Name	*Description*	*Assignment Via*
ExBlo1-I	Module Input State: External Blocking1	[Protection Para /Global Prot Para /I-Prot /IH2[1]]
ExBlo2-I	Module Input State: External Blocking2	[Protection Para /Global Prot Para /I-Prot /IH2[1]]

IH2 Module Signals (Output States)

Name	*Description*
Active	Signal: Active
ExBlo	Signal: External Blocking
Blo Phase A	Signal: Blocked Phase A
Blo Phase B	Signal: Blocked Phase B
Blo Phase C	Signal: Blocked Phase C
Blo IG	Signal: Blocking of the Earth Protection Module
3-ph Blo	Signal: Inrush was detected in at least one phase - trip command blocked.

Commissioning: IH2

NOTICE

Dependent on the configured IH2 module blocking mode (»*1-ph Blo or 3-ph Blo*«), the test procedure is different.

For mode »*1-ph-Blo*«, the test has to be carried out first for each individual phase and then for all three phases together.

For mode »*3-ph-Blo*«, the test is a three-phase test.

Object to be tested:
Test of the IH2 module harmonic blocking.

Necessary means:
- Three-phase current source with adjustable frequency; and
- Three-phase current source (for the fundamental harmonic).

Procedure (dependent on the configured blocking mode):

- Feed the current to the secondary side with nominal frequency.
- Abruptly feed current to the secondary side with double nominal frequency. The amplitude must exceed the pre-set ratio/threshold »*IH2/IN*«.
- Ascertain that the signal »IH2 ALARM« is now generated.

Successful test results:
The signal »IH2 ALARM« is generated and the event recorder indicates the blocking of the current protection element.

51Q-Negative-Sequence Overcurrent Protection [51Q]

Elements
51Q[1] ,51Q[2]

The negative-sequence overcurrent element (*51Q*) is to be seen as an equivalent to the phase overcurrent protection (51P) with the exception that it uses negative-sequence current (I2) as measured quantities instead of the three phase currents used by phase overcurrent elements. The negative-sequence current used by *51Q* is derived from the following well-known symmetrical component transformation:

$$I_2 = \frac{1}{3}(I_A + a^2 I_B + a I_C)$$

The pickup set value of a *51Q* element should be set in accordance of the negative-sequence current occurrence in the protected object.

Besides that, the negative-sequence overcurrent element (*51Q*) uses the same setting parameters as the phase overcurrent elements (51P), like trip and reset characteristics from both IEC/ANSI standards, time multiplier, etc.

The negative-sequence overcurrent element (*51Q*) can be used by line, generator, transformer and motor protection to protect the system from unbalanced faults. Because the *51Q* element operates on the negative-sequence current component which is normally absent during load conditions, the *51Q* can, therefore, be set more sensitive than the phase overcurrent elements (*51P*). On the other hand, coordination of negative-sequence overcurrent elements in a radial system does not mean automatically very long fault clearing time for the furthest upstream protection devices, because the tripping time of concerned negative-sequence overcurrent element needs only be coordinate with the next downstream device with the negative-sequence overcurrent element. This makes the *51Q* in many cases as an advantageous protection concept in addition to the phase overcurrent elements.

WARNING **If you are using inrush blockings, the tripping delay of the current protection functions must be at least 30 ms or more in order to prevent faulty trippings.**

NOTICE **All elements are identically structured.**

For each element, the following characteristics are available:

- NINV (IEC/XInv)
- VINV (IEC/XInv)
- LINV (IEC/XInv)
- EINV (IEC/XInv)
- MINV (ANSI/XInv)
- VINV (ANSI/XInv)
- EINV (ANSI/XInv)
- Thermal Flat
- Therm Flat IT
- Therm Flat I2T
- Therm Flat I4T

Explanation:

t = Tripping delay

t-multiplier = Time multiplier/tripping characteristic factor

I2 = Measured value (calculated): Unbalanced load current

Pickup = If the pickup value is exceeded, the module/element starts to time out to trip.

NOTICE **At the moment of breaker closure, negative-sequence current might be the result of transients.**

IEC NINV

Notice!

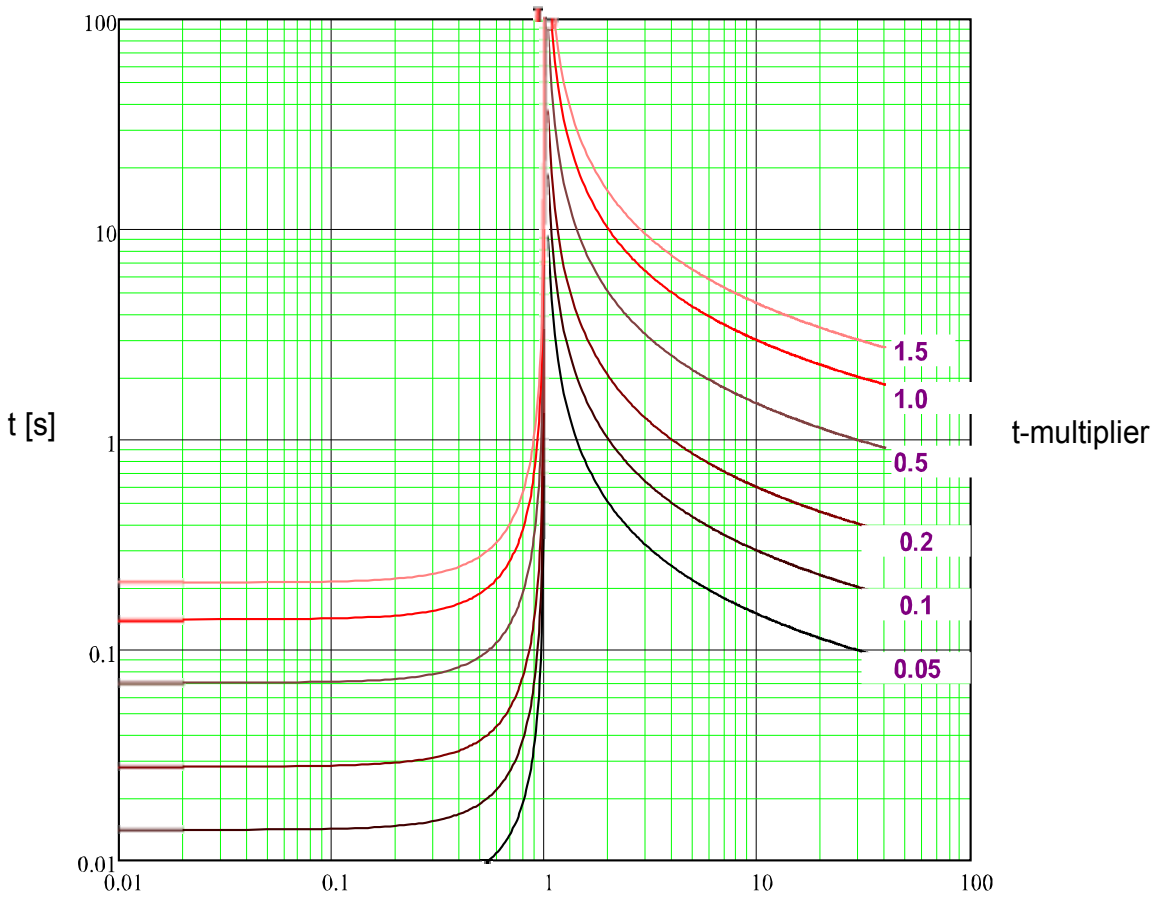
Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

Reset

$$t = \left| \frac{0.14}{\left(\frac{I2}{Pickup}\right)^{2} - 1} \right| * \text{t-multiplier [s]}$$

Trip

$$t = \frac{0.14}{\left(\frac{I2}{Pickup}\right)^{0.02} - 1} * \text{t-multiplier [s]}$$



IEC VINV

Notice!

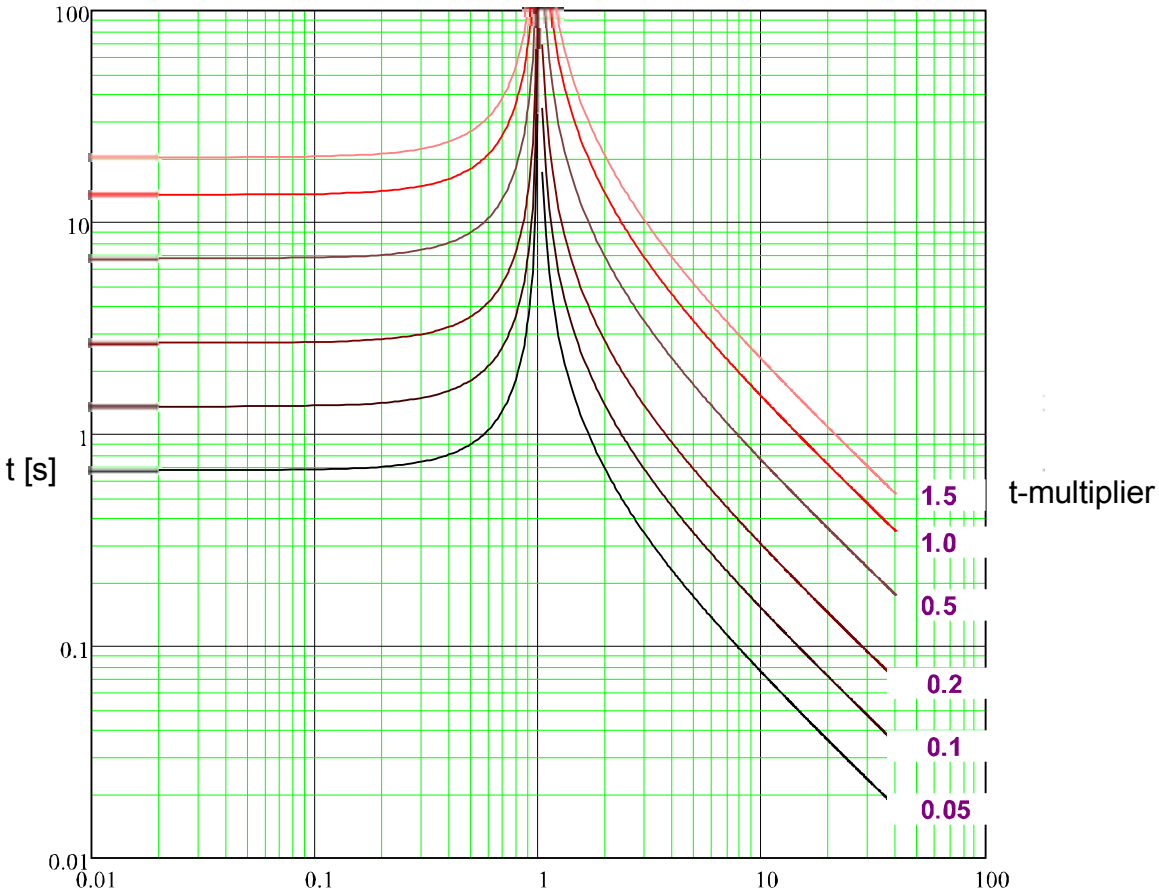
Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

Reset

$$t = \left| \frac{13.5}{\left(\frac{I2}{Pickup}\right)^2 - 1} \right| * \text{t-multiplier [s]}$$

Trip

$$t = \frac{13.5}{\left(\frac{I2}{Pickup}\right) - 1} * \text{t-multiplier [s]}$$



IEC LINV

Notice!

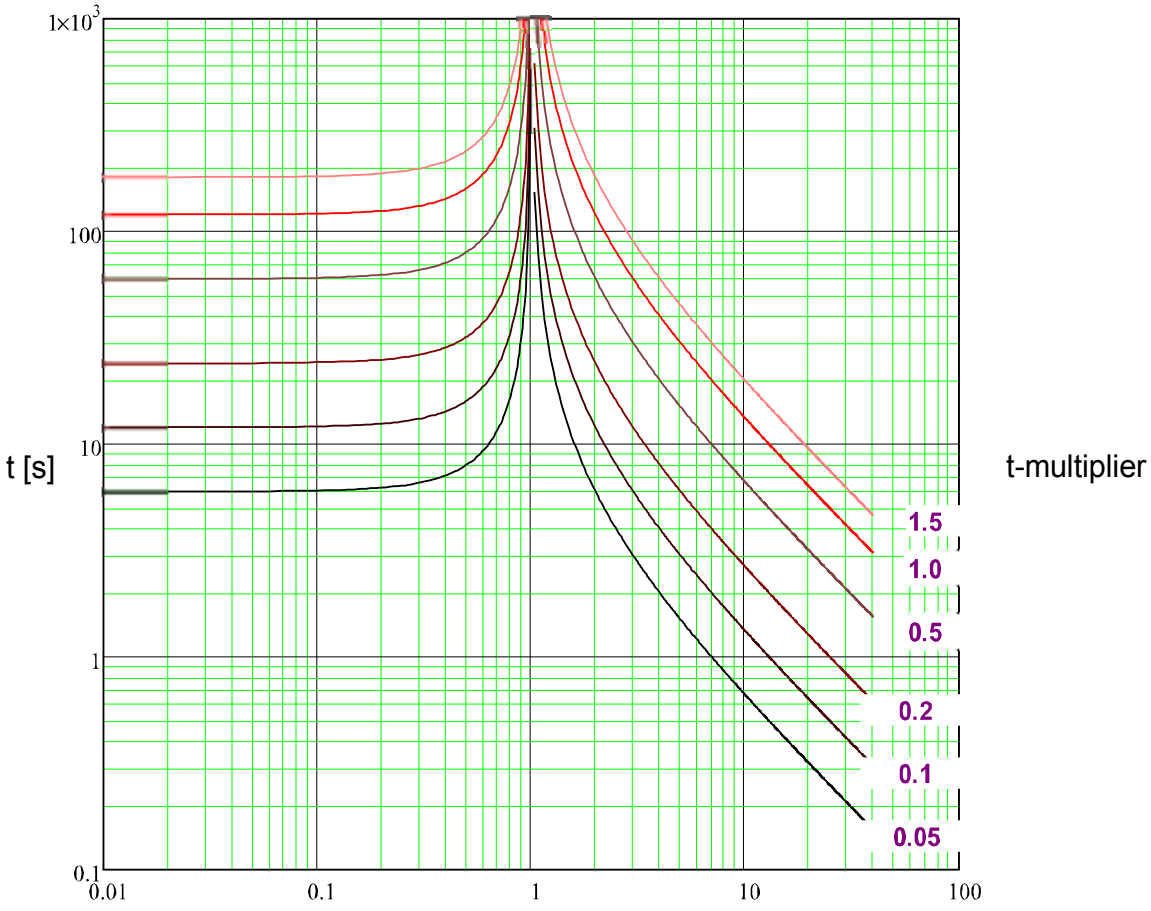
Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

Reset

$$t = \left| \frac{120}{\left(\frac{I2}{Pickup}\right)^{2}-1} \right| * \text{t-multiplier [s]}$$

Trip

$$t = \frac{120}{\left(\frac{I2}{Pickup}\right)-1} * \text{t-multiplier [s]}$$



IEC EINV

Notice!

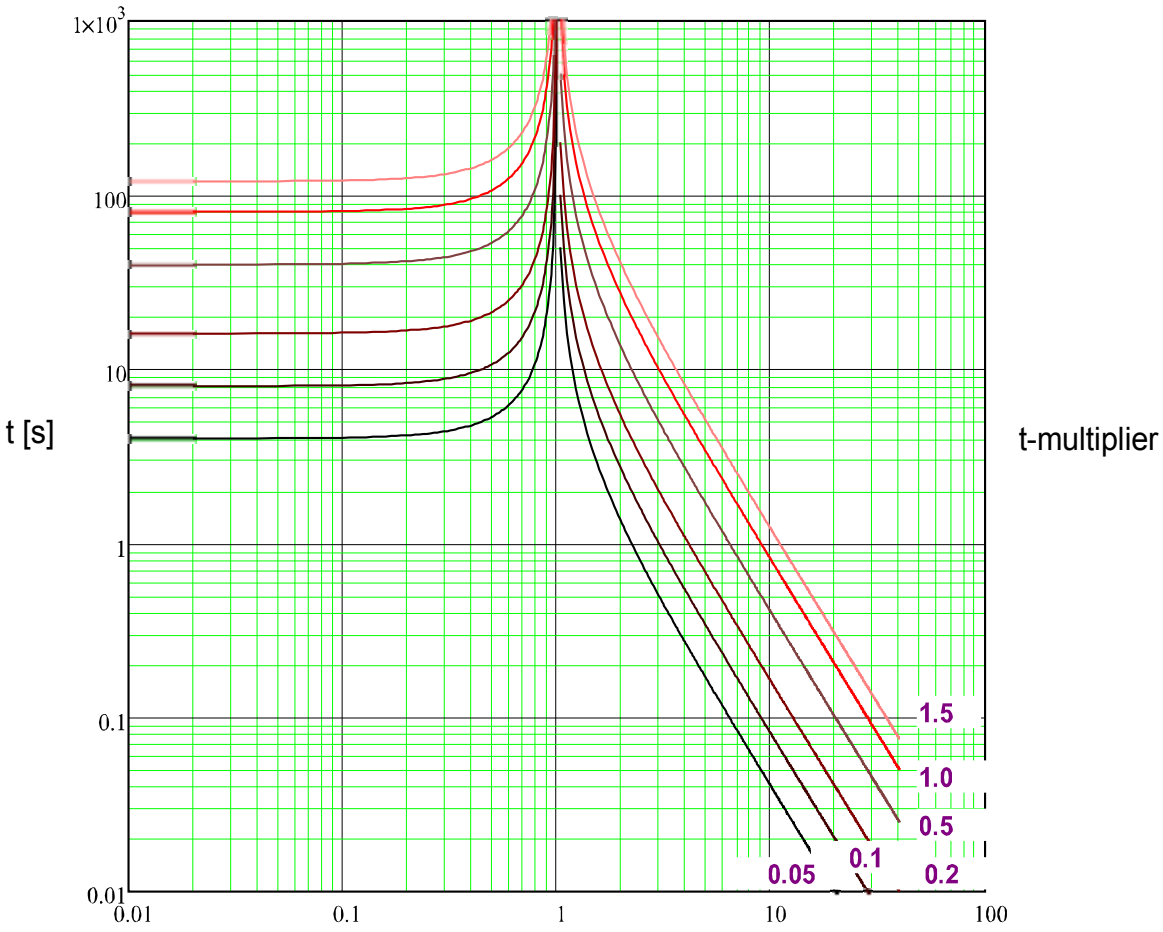
Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

Reset

$$t = \left| \frac{80}{\left(\frac{I2}{Pickup}\right)^2 - 1} \right| * \text{t-multiplier [s]}$$

Trip

$$t = \frac{80}{\left(\frac{I2}{Pickup}\right)^2 - 1} * \text{t-multiplier [s]}$$



ANSI MINV

Notice!

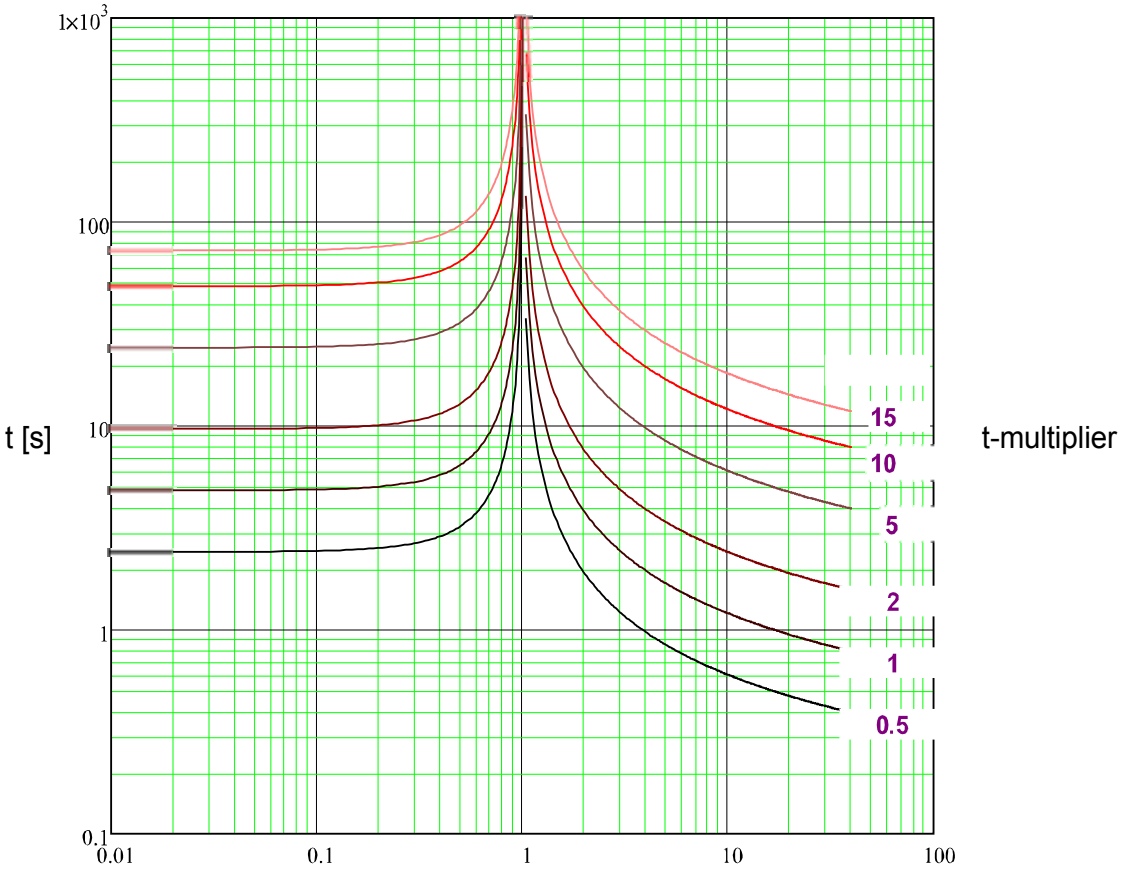
Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

Reset

$$t = \left| \frac{4.85}{\left(\frac{I2}{Pickup}\right)^2 - 1} \right| \text{*t-multiplier [s]}$$

Trip

$$t = \left(\frac{0.0515}{\left(\frac{I2}{Pickup}\right)^{0.02} - 1} + 0.1140 \right) \text{*t-multiplier [s]}$$



ANSI VINV

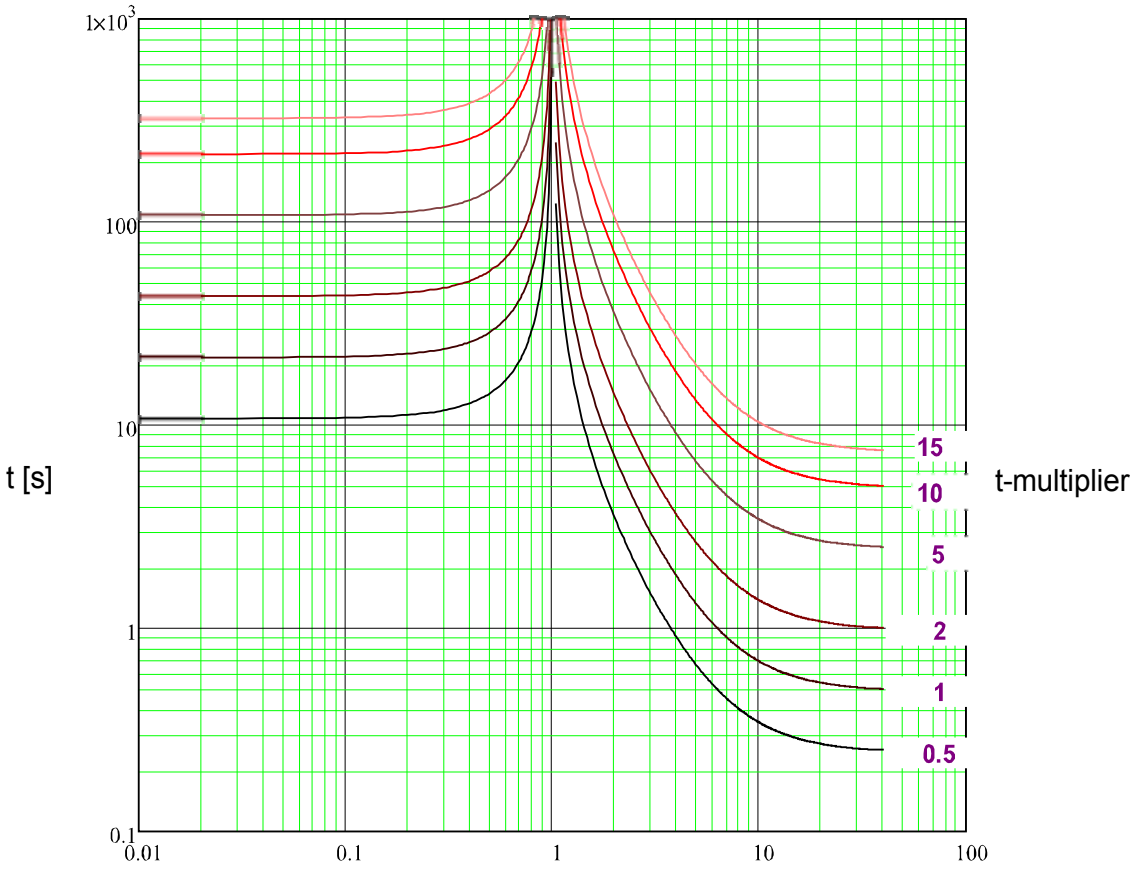
Notice!
Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

Reset

$$t = \left| \frac{21.6}{\left(\frac{I2}{Pickup}\right)^2 - 1} \right| * \text{t-multiplier [s]}$$

Trip

$$t = \left(\frac{19.61}{\left(\frac{I2}{Pickup}\right)^2 - 1} + 0.491 \right) * \text{t-multiplier [s]}$$



ANSI EINV

Notice!

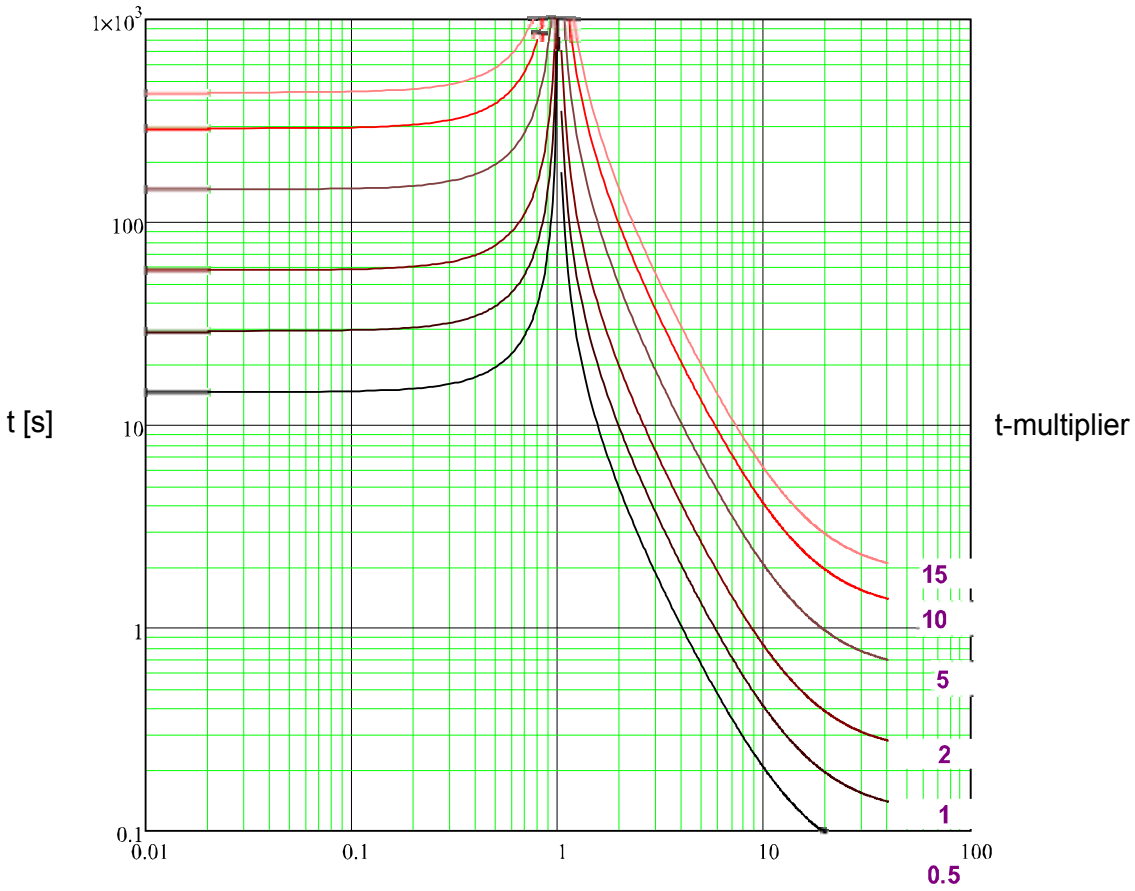
Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

Reset

$$t = \left| \frac{29.1}{\left(\frac{I2}{Pickup}\right)^2 - 1} \right| * \text{t-multiplier [s]}$$

Trip

$$t = \left(\frac{28.2}{\left(\frac{I2}{Pickup}\right)^2 - 1} + 0.1217 \right) * \text{t-multiplier [s]}$$



x * Pickup (Multiples of Pickup)

Therm Flat

Notice!

Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

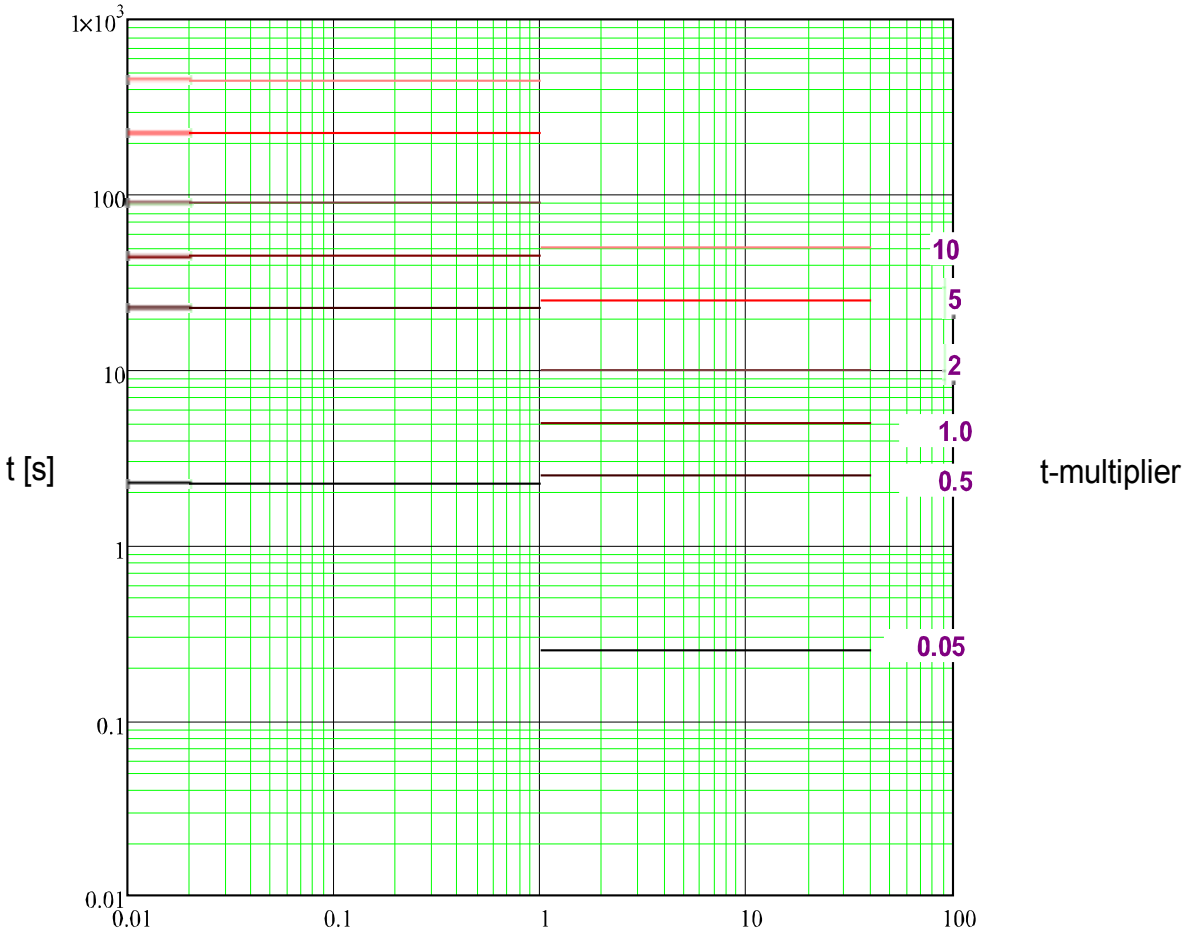
Reset

$$t = \left| \frac{5*3^{2}}{\left(\frac{I2}{In}\right)^{0}} \right| *\text{t-multiplier [s]}$$

Trip

$$t = \frac{5*1^{2}}{\left(\frac{I2}{In}\right)^{0}} *\text{t-multiplier [s]}$$

$$t = 45 *\text{t-multiplier [s]}$$



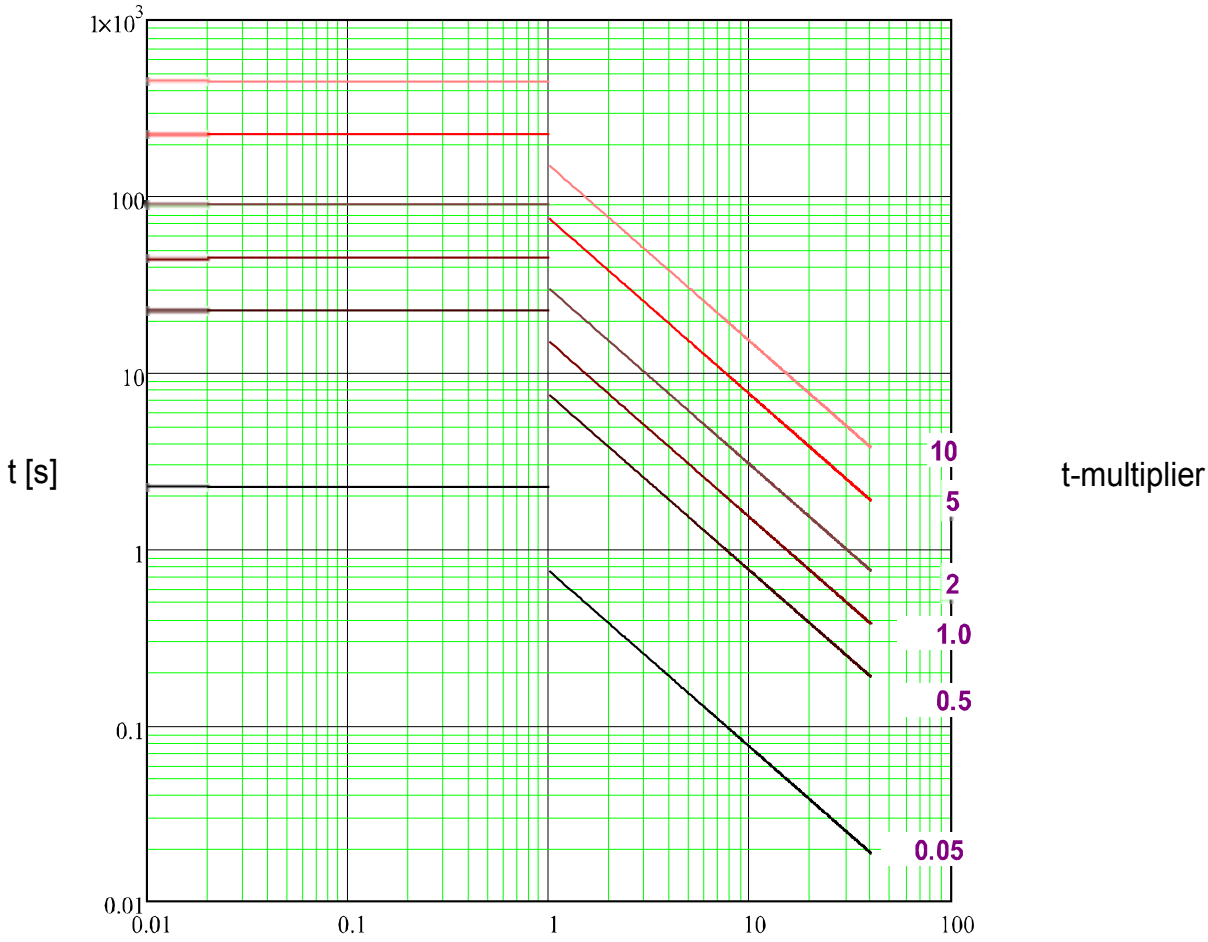
IT

Notice!

Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

Reset **Trip**

$$t = \left| \frac{5*3^{2}}{\left(\frac{I2}{In}\right)^{0}} \right| *\text{t-multiplier [s]} \qquad t = \frac{5*3^{1}}{\left(\frac{I2}{In}\right)^{1}} *\text{t-multiplier [s]}$$



I2T

Notice!

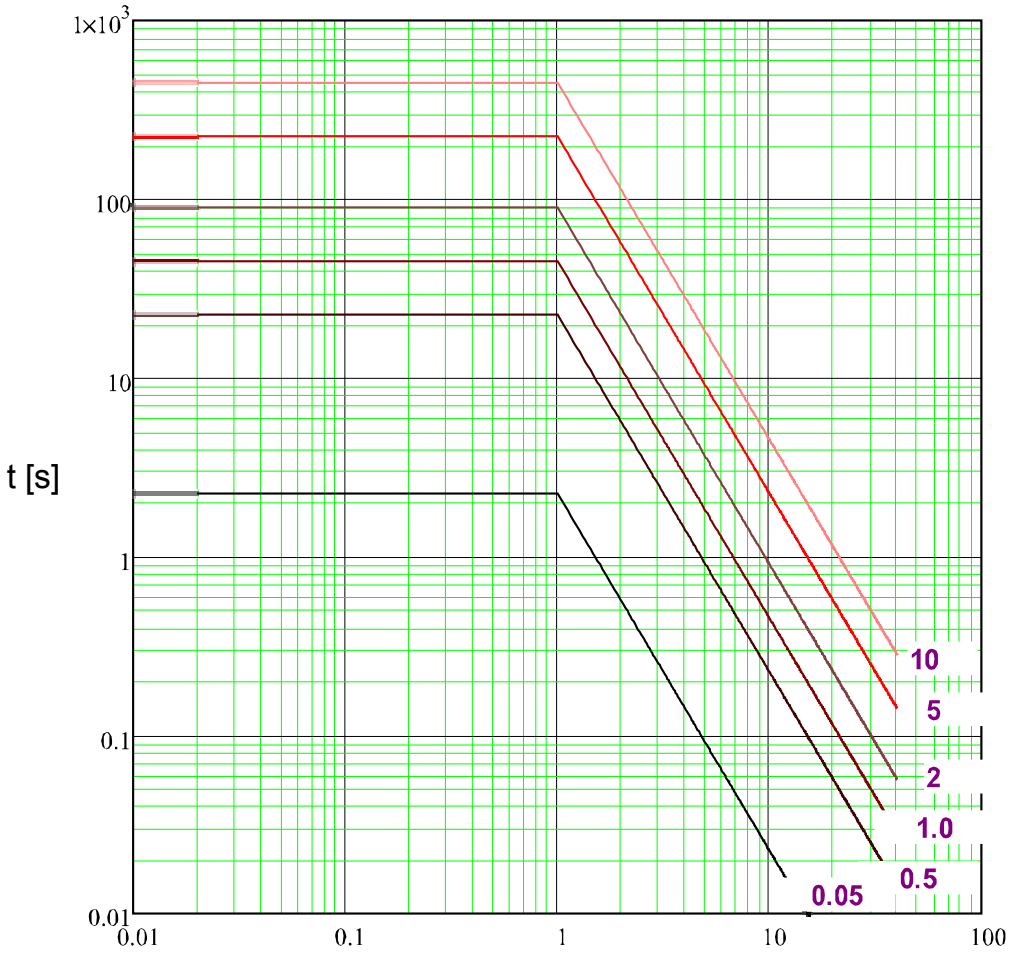
Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

Reset

$$t = \left| \frac{5 * 3^2}{\left(\frac{I2}{In}\right)^0} \right| * \text{t-multiplier [s]}$$

Trip

$$t = \frac{5 * 3^2}{\left(\frac{I2}{In}\right)^2} * \text{t-multiplier [s]}$$



x * In (Multiples of the Nominal Current)

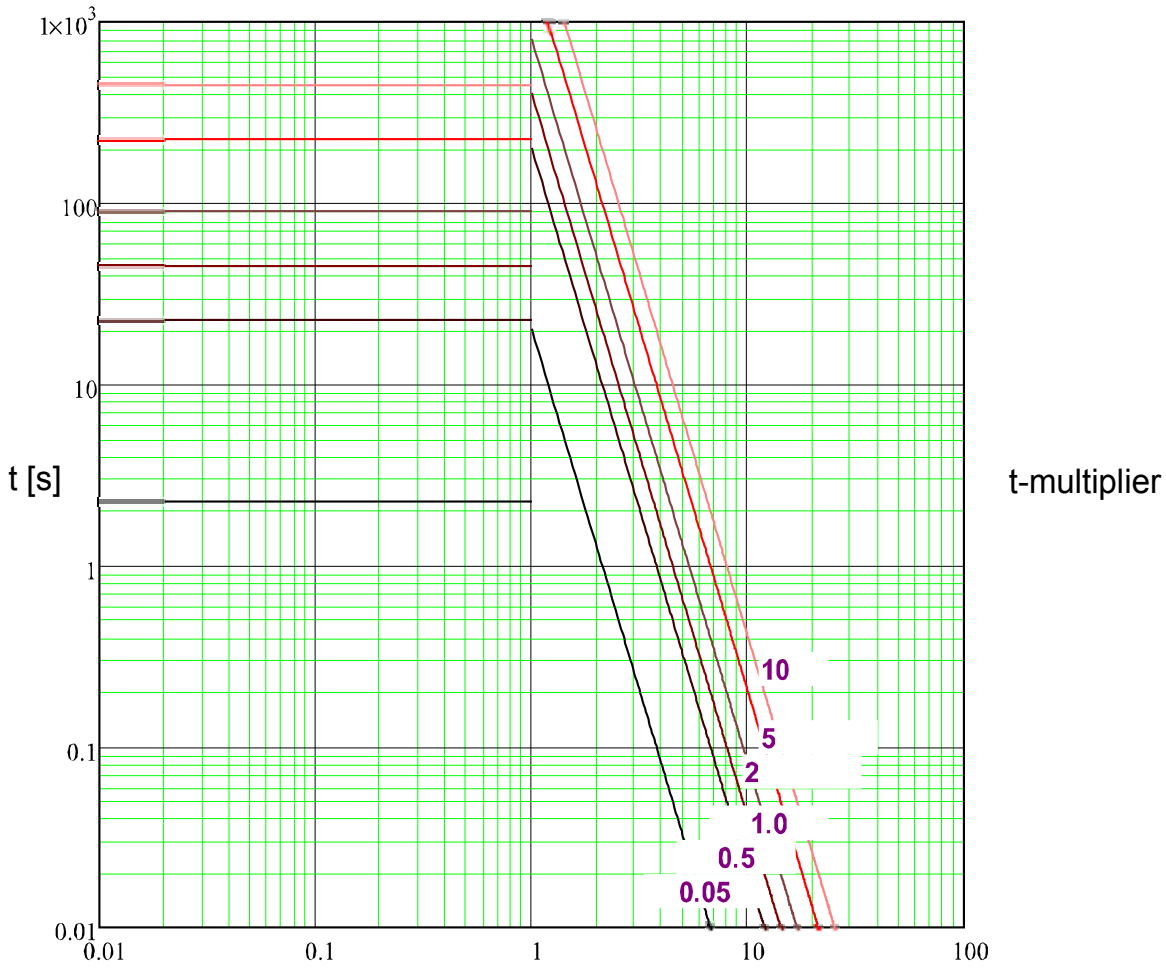
I4T

Notice!

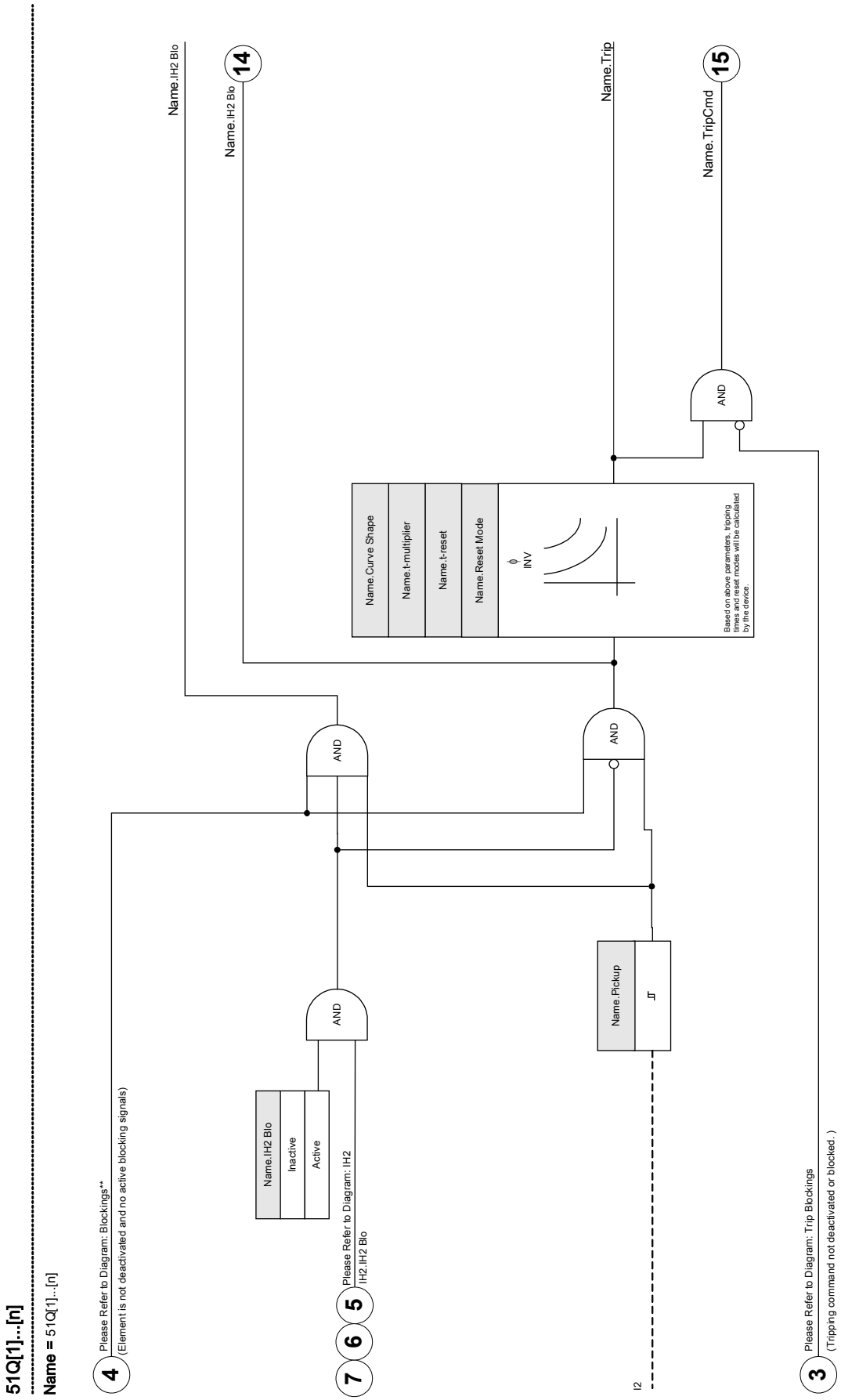
Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

Reset **Trip**

$$t = \left| \frac{5*3^{2}}{\left(\frac{I2}{In}\right)^{0}} \right| *\text{t-multiplier [s]} \qquad t = \frac{5*3^{4}}{\left(\frac{I2}{In}\right)^{4}} *\text{t-multiplier [s]}$$



x *In (Multiples of the Nominal Current)


51Q[1]...[n]
Name = 51Q[1]...[n]
4
Please Refer to Diagram: Blockings**
(Element is not deactivated and no active blocking signals)
Name.IH2 Blo
Inactive
Active
AND
7
6
5
Please Refer to Diagram: IH2
IH2.IH2 Blo
Name.IH2 Blo
14
Name.IH2 Blo
AND
Name.Pickup
I2
Name.Curve Shape
Name.t-multiplier
Name.t-reset
Name.Reset Mode
INV
Based on above parameters, tripping times and reset modes will be calculated by the device.
Name.Trip
AND
Name.TripCmd
15
3
Please Refer to Diagram: Trip Blockings
(Tripping command not deactivated or blocked.)

Device Planning Parameters of the 51Q Module

Parameter	*Description*	*Options*	*Default*	*Menu Path*
Mode	Mode	Non-directional	Non-directional	[Device Planning]

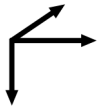
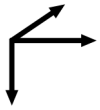
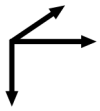
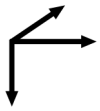
Global Protection Parameters of the 51Q Module

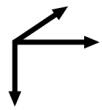
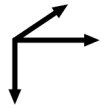
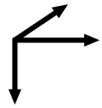
Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Winding Side	Winding Side	W1, W2	51Q[1]: W1 51Q[2]: W2	[Protection Para /Global Prot Para /I-Prot /51Q[1]]
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /51Q[1]]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /51Q[1]]
ExBlo TripCmd	External blocking of the Trip Command of the module/the element, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /51Q[1]]
Rvs Blo	Reverse Blocking, if Reverse Blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /51Q[1]]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
AdaptSet 1	Assignment Adaptive Parameter 1	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /51Q[1]]
AdaptSet 2	Assignment Adaptive Parameter 2	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /51Q[1]]
AdaptSet 3	Assignment Adaptive Parameter 3	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /51Q[1]]
AdaptSet 4	Assignment Adaptive Parameter 4	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /51Q[1]]

Setting Group Parameters of the 51Q Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Function	Permanent activation or deactivation of module/element.	Inactive, Active	Active	[Protection Para /<n> /I-Prot /51Q[1]]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /51Q[1]]
Rvs Blo Fc	Activate (allow) or inactivate (disallow) reverse blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/element are blocked that are parameterized "Rvs Blo Fc = active".	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /51Q[1]]
Blo TripCmd	Permanent blocking of the Trip Command of the module/element.	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /51Q[1]]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
ExBlo TripCmd Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo TripCmd Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /51Q[1]]
Pickup 	If the pickup value is exceeded, the module/element starts to time out to trip.	0.01 - 40.00In	1.00In	[Protection Para /<n> /I-Prot /51Q[1]]
Curve Shape 	Characteristic	IEC NINV, IEC VINV, IEC EINV, IEC LINV, ANSI MINV, ANSI VINV, ANSI EINV, Therm Flat, IT, I2T, I4T	ANSI MINV	[Protection Para /<n> /I-Prot /51Q[1]]
t-multiplier 	Time multiplier/tripping characteristic factor	0.05 - 20.00	1.0	[Protection Para /<n> /I-Prot /51Q[1]]
Reset Mode 	Reset Mode	Instantaneous, t-delay, Calculated	Calculated	[Protection Para /<n> /I-Prot /51Q[1]]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
t-reset 	Reset time for intermittent phase failures (INV characteristics only) Available if:Reset Mode = t-delay	0.00 - 60.00s	0s	[Protection Para /<n> /I-Prot /51Q[1]]
IH2 Blo 	Blocking the trip command, if an inrush is detected.	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /51Q[1]]
Nondir Trip at V=0 	Only relevant for current protection modules/elements with directional feature! The device will trip non directional if this parameter is set to active and no direction could be determined because no reference voltage (V=0) could be measured any more (e.g. if there is a three-phase short circuit close to the device). If this parameter is set to inactive, the protection stage will be blocked in case of V=0. Only available if: Device Planning: I.Mode = Directional	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /51Q[1]]

51Q Module Input States

Name	*Description*	*Assignment Via*
ExBlo1-I	Module Input State: External Blocking1	[Protection Para /Global Prot Para /I-Prot /51Q[1]]
ExBlo2-I	Module Input State: External Blocking2	[Protection Para /Global Prot Para /I-Prot /51Q[1]]
ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command	[Protection Para /Global Prot Para /I-Prot /51Q[1]]
Rvs Blo-I	Module Input State: Reverse Blocking	[Protection Para /Global Prot Para /I-Prot /51Q[1]]
AdaptSet1-I	Module Input State: Adaptive Parameter1	[Protection Para /Global Prot Para /I-Prot /51Q[1]]
AdaptSet2-I	Module Input State: Adaptive Parameter2	[Protection Para /Global Prot Para /I-Prot /51Q[1]]
AdaptSet3-I	Module Input State: Adaptive Parameter3	[Protection Para /Global Prot Para /I-Prot /51Q[1]]
AdaptSet4-I	Module Input State: Adaptive Parameter4	[Protection Para /Global Prot Para /I-Prot /51Q[1]]

51Q Module Signals (Output States)

Name	*Description*
Active	Signal: Active
ExBlo	Signal: External Blocking
Rvs Blo	Signal: Reverse Blocking
Blo TripCmd	Signal: Trip Command blocked
ExBlo TripCmd	Signal: External Blocking of the Trip Command
IH2 Blo	Signal: Blocking the trip command by IH2
Pickup	Signal: Pickup
Trip	Signal: Trip
TripCmd	Signal: Trip Command
Active AdaptSet	Active Adaptive Parameter
DefaultSet	Signal: Default Parameter Set
AdaptSet 1	Signal: Adaptive Parameter 1
AdaptSet 2	Signal: Adaptive Parameter 2
AdaptSet 3	Signal: Adaptive Parameter 3
AdaptSet 4	Signal: Adaptive Parameter 4

Commissioning: Unbalanced Load [51Q]

Object to be tested

- Signals to be measured for each current protection element: the threshold values, total tripping time (recommended), or alternatively tripping delays and the dropout ratios.

NOTICE

Eaton recommends measuring the total tripping time instead of the tripping delay. The tripping delay should be specified by the customer. The total tripping time is measured at the position signaling contact of the breaker (not at the relay output contacts!).

Total tripping time = tripping delay (please refer to the tolerances of the protection stages)
+ breaker operating time (about 50 ms)

Please take the breaker operating times from the technical data specified in the relevant documentation provided by the breaker manufacturer.

Necessary means:
- Current source
- Current meters
- Timer

Procedure:

Testing the threshold values

In order to get a negative-sequence current, please change the phase sequence at the terminals of the current source (in case of ABC sequence to ACB – in case of a ACB sequence to ABC).

For each test performed, feed a current that is about 3-5% above the threshold value for activation/tripping. Then check the threshold values.

Testing the total tripping delay (recommendation)
Measure the total tripping times at the auxiliary contacts of the breakers (breaker tripping).

Testing the tripping delay (measuring at the relay output contact)
Measure the tripping times at the relay output contact.

Testing the dropout ratio
Reduce the current to 97% below the trip value and check the dropout ratio.

Successful test result
The measured total tripping delays or individual tripping delays, threshold values, and dropout ratios correspond with those values specified in the adjustment list. Permissible deviations/tolerances can be found under Technical Data.

SOTF-Protection Module: Switch Onto Fault

SOTF

In case a faulty line is energized (e.g.: when an earthing switch is in the ON-Position), an instantaneous trip is required. The SOTF module is provided to generate a permissive signal for other protection functions such as overcurrents to accelerate their trips. The SOTF condition is recognized according to the User's operation mode that can be based on:

- The breaker state;
- No current flowing;
- Breaker state and no current flowing;
- Breaker switched on manually; and/or
- An external trigger.

This protection module can initiate a high speed trip of the overcurrent protection modules. The module can be started via a digital input that indicates that the breaker is manually closed.

CAUTION

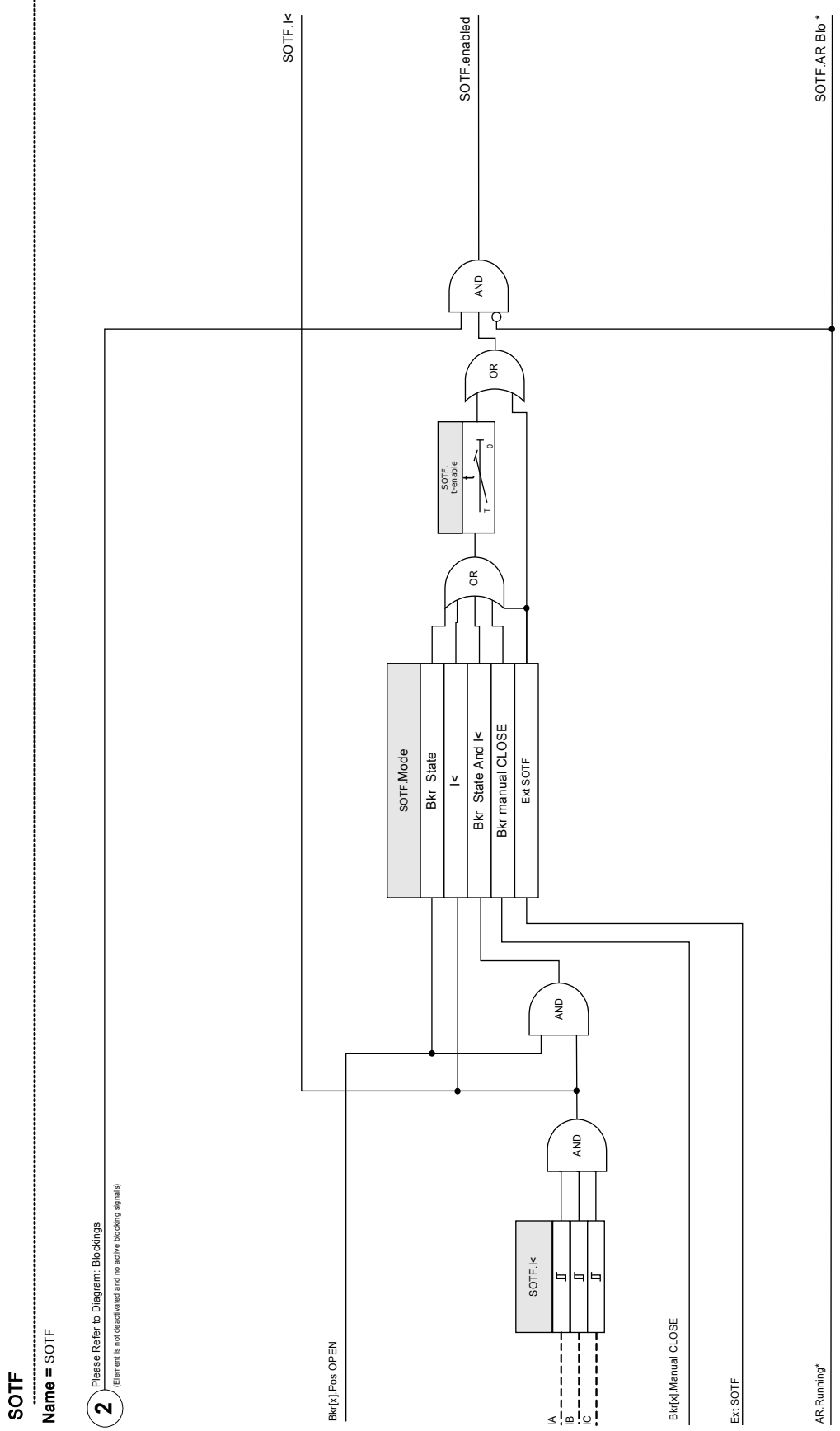
This module issues a signal only (the module is not armed and does not issue a trip command).

In order to influence the trip settings of the overcurrent protection in case of switching onto a fault, the User has to assign the signal "SOTF.ENABLED" onto an Adaptive Parameter Set. Please refer to Parameter / Adaptive Parameter Sets sections. Within the Adaptive Parameter Set, the User has to modify the trip characteristic of the overcurrent protection according to the User's needs.

SOTF

Name = SOTF

2 Please Refer to Diagram: Blockings
(Element is not deactivated and no active blocking signals)



*Applies only for devices with Auto Reclosure

Device Planning Parameters of the Switch Onto Fault Module

Parameter	*Description*	*Options*	*Default*	*Menu Path*
Mode	Mode	Do not use, Use	Use	[Device Planning]

Global Protection Parameters of the Switch Onto Fault Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Winding Side	Winding Side	W1, W2	W1	[Protection Para /Global Prot Para /SOTF]
Mode	Mode	Bkr State, I<, Bkr State And I<, Bkr manual CLOSE, Ext SOTF	Bkr manual CLOSE	[Protection Para /Global Prot Para /SOTF]
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /SOTF]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /SOTF]
Rvs Blo	Reverse Blocking, if Reverse Blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /SOTF]
Manual CLOSE	The breaker was switched on manually if the state of the assigned signal is true. This digital input can be used by some protective elements (if they are available within the device) like Switch Onto Fault (SOTF), e.g. as a trigger signal. Only available if: Mode = Bkr manual CLOSE	-.-, Bkr[1].Manual CLOSE, Bkr[2].Manual CLOSE	-.-	[Protection Para /Global Prot Para /SOTF]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Bkr Pos Detect	Criterion by which the Breaker Switch Position is to be detected. Only available if: Mode = Bkr State Or Bkr State And I<	-.-, Bkr[1].State, Bkr[2].State	Bkr[1].State	[Protection Para /Global Prot Para /SOTF]
Ext SOTF	External Switch Onto Fault Only available if: Mode = Ext SOTF	-.-, DI Slot X1.DI 1, DI Slot X1.DI 2, DI Slot X1.DI 3, DI Slot X1.DI 4, DI Slot X1.DI 5, DI Slot X1.DI 6, DI Slot X1.DI 7, DI Slot X1.DI 8	-.-	[Protection Para /Global Prot Para /SOTF]

Setting Group Parameters of the Switch Onto Fault Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Function	Permanent activation or deactivation of module/element.	Inactive, Active	Inactive	[Protection Para /<n> /SOTF]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /SOTF]
Rvs Blo Fc	Activate (allow) or inactivate (disallow) reverse blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/element are blocked that are parameterized "Rvs Blo Fc = active".	Inactive, Active	Inactive	[Protection Para /<n> /SOTF]
I<	The breaker is in the OPEN Position, if the measured current is less than this parameter.	0.01 - 1.00In	0.01In	[Protection Para /<n> /SOTF]
t-enable	While this timer is running, and while the module is not blocked, the Switch Onto Fault Module is effective (SOTF is armed).	0.10 - 10.00s	2s	[Protection Para /<n> /SOTF]

Switch Onto Fault Module Input States

Name	*Description*	*Assignment Via*
ExBlo1-I	Module Input State: External Blocking	[Protection Para /Global Prot Para /SOTF]
ExBlo2-I	Module Input State: External Blocking	[Protection Para /Global Prot Para /SOTF]
Rvs Blo-I	Module Input State: Reverse Blocking	[Protection Para /Global Prot Para /SOTF]
Manual CLOSE-I	Module Input State: Breaker was switched on manually.	[Protection Para /Global Prot Para /SOTF]
Bkr Pos Detect-I	Module Input State: Criterion by which the Breaker Switch Position is to be detected.	[Protection Para /Global Prot Para /SOTF]
Ext SOTF-I	Module Input State: External Switch Onto Fault Alarm	[Protection Para /Global Prot Para /SOTF]

Signals of the Switch Onto Fault Module (Output States)

Name	*Description*
Active	Signal: Active
ExBlo	Signal: External Blocking
Rvs Blo	Signal: Reverse Blocking
enabled	Signal: Switch Onto Fault enabled. This Signal can be used to modify Overcurrent Protection Settings.
I<	Signal: No Load Current.

Commissioning: Switch Onto Fault [ANSI 50HS]

Object to be tested:

Testing the module *Switch Onto Fault* according to the configured operating mode:

•I< (No current);
•Bkr state (Breaker position);
•I< (No current) and Bkr state (Position of the breaker); and
•Bkr manual ON.

Necessary means:

•Three-phase current source (If the Enable-Mode depends on current);
•Ampere meters (May be needed if the Enable-Mode depends on current); and
•Timer.

Test Example for Mode Bkr Manual ON

NOTICE

Mode I<: In order to test the effectiveness: Initially do not feed any current. Start the timer and feed with an abrupt change current that is distinctly greater than the I<-threshold to the measuring inputs of the relay.

Mode I< and Bkr state: Simultaneous switch on the breaker manually and feed with an abrupt change current that is distinctly greater than the I<-threshold.

Mode Bkr state: The breaker has to be in the OFF Position. The signal „SOTF.ENABLED“=0 is untrue. If the breaker is switched on, the signal „SOTF.ENABLED“=1 becomes true as long as the timer t-effective is running.

•The breaker has to be in the OFF position. There must be no load current.

•The status display of the device shows the signal "SOTF.ENABLED“=1.

Testing:

•Manually switch the breaker to the ON position and start the timer at the same time.

•After the hold time t-enable is expired, the state of the signal has to change to "SOTF.enabled“=0.

•Write down the measured time.

Successful test result:

The measured total tripping delays or individual tripping delays, threshold values, and drop-out ratios correspond with those values, specified in the adjustment list. Permissible deviations/tolerances can be found under Technical Data.

CLPU - Supervision Module Cold Load Pickup

Available Elements:
CLPU

When the electric load is freshly started or restarted after a prolonged outage, the load current tends to have a temporary surge that could be several times the normal load current in magnitude due to motor starting. This phenomena is called cold load inrush. If the overcurrent pickup threshold is set according to the maximum possible load inrush, the overcurrent protection may be insensitive to some faults, thus making whole protection systems coordination difficult or even impossible. On the other hand, the overcurrent protection could trip on load inrush if it is set based on the fault current studies. The CLPU module is provided to generate a temporary blocking/desensitizing signal to prevent overcurrent protections from unwanted tripping. The load off condition is recognized according to the User's criterion which can be based on:

•The breaker status;

•No current flowing;

•Breaker and no current flowing; and/or

•Breaker status or no current flowing.

NOTICE

This applies to transformer applications only.

Note that only one CLPU unit is offered. Therefore the breaker status and the currents must be used from one winding side. The cold load pickup condition is recognized after the load is off (trigger event fulfilled) for a period specified by the User (t-LoadOff). While in the cold load pickup condition, when the load is re-energized, the cold load pickup condition will be maintained for a period specified as t-MaxBlock.

The following countermeasures against unwanted tripping are available.

•Blocking of the overcurrent protection.

•Increasing the tripping thresholds respective of the tripping times by means of adaptive parameters.

CAUTION

This module issues a signal only (it is not armed).

In order to influence the tripping settings of the overcurrent protection, the User has to assign the signal "CLPU.ENABLED" onto an adaptive parameter set. Please refer to the Parameter / Adaptive Parameter Sets section. Within the adaptive parameter set, you have to modify the tripping characteristic of the overcurrent protection according to your needs.

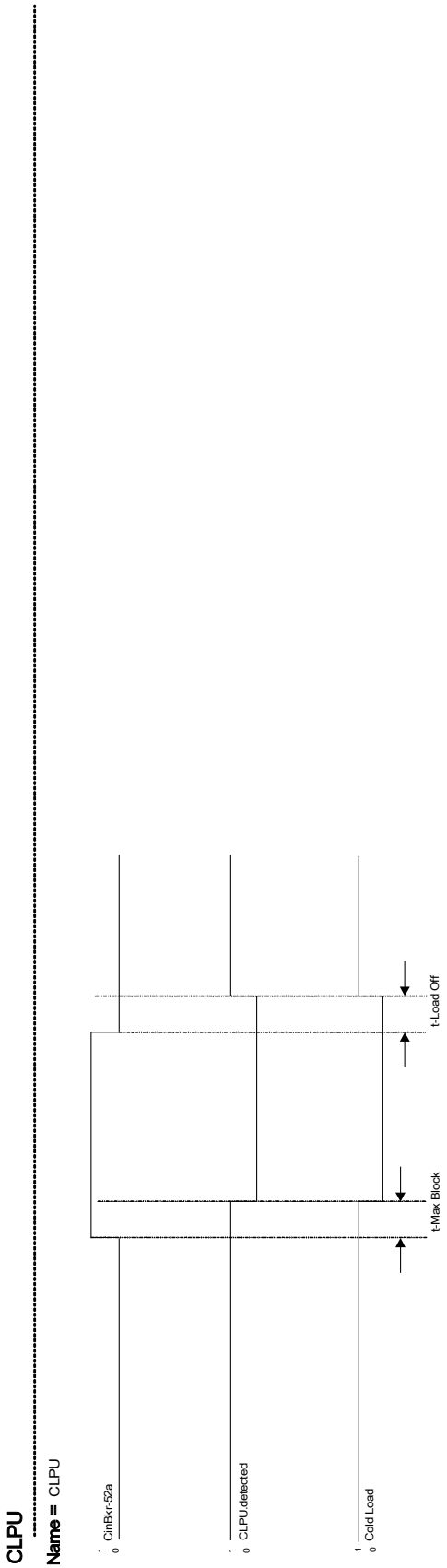
NOTICE

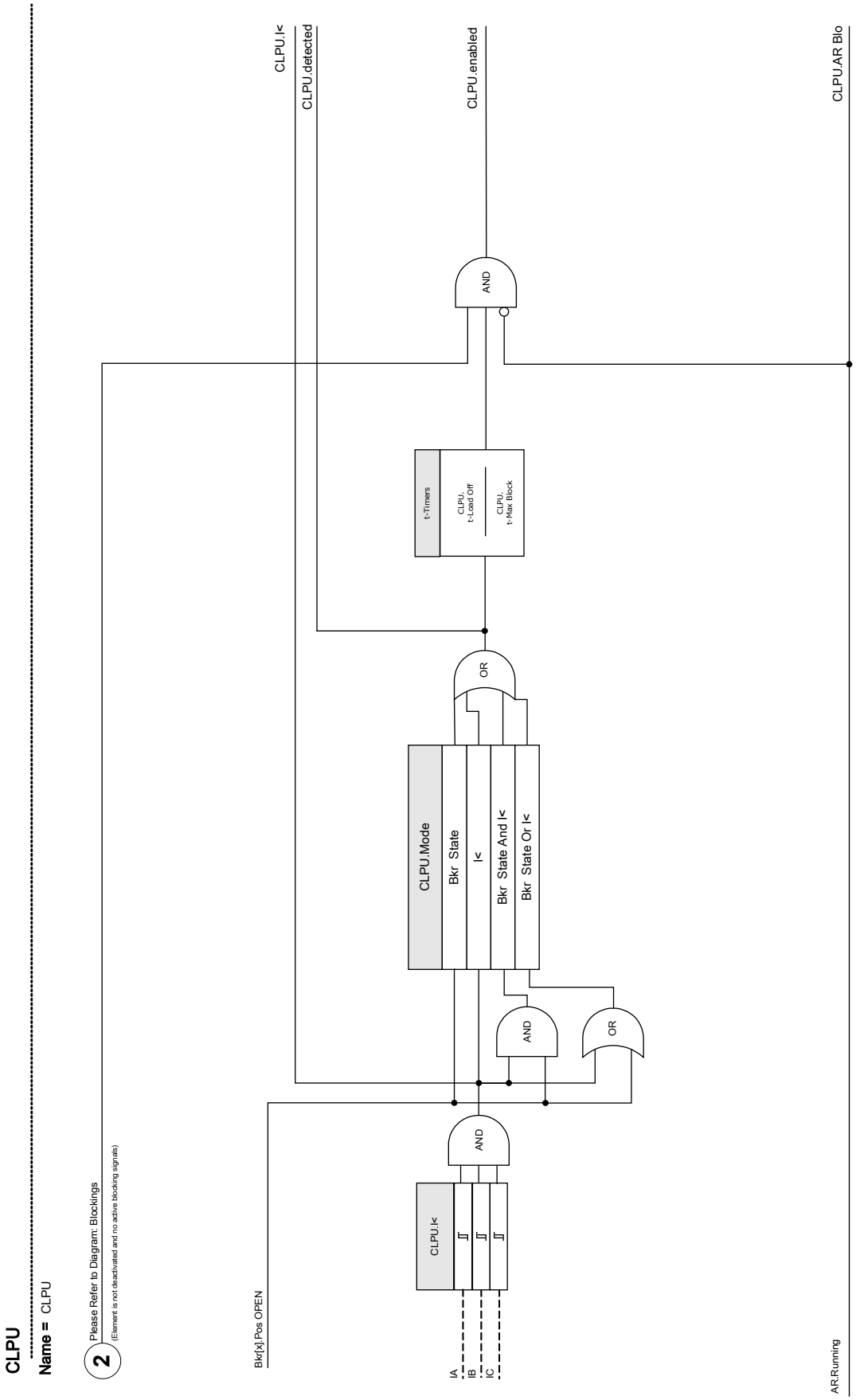
Please be aware of the meaning of the two delay timers.

t load Off (Pickup Delay): After this time expires, the load is no longer diversified.

t Max Block (Release Delay): After the starting condition is fulfilled (e.g.: breaker switched on manually), the CLPU.enabled signal will be issued for this time. That means for the duration of this time, the tripping thresholds of the overcurrent protection can be desensitized by means of adaptive parameters (please refer to the Parameters section).

Example Mode: Breaker Position




CLPU
Name = CLPU
2
Please Refer to Diagram: Blockings
(Element is not deactivated and no active blocking signals)
CLPU.I<
CLPU.detected
CLPU.enabled
CLPU.AR Blo
t-Timers
CLPU.
t-Load Off
CLPU.
t-Max Block
AND
OR
CLPU.Mode
Bkr State
I<
Bkr State And I<
Bkr State Or I<
AND
OR
CLPU.I<
AND
Bkr[x].Pos OPEN
IA
IB
IC
AR.Running

Device Planning Parameters of the Cold Load Pickup Module

Parameter	*Description*	*Options*	*Default*	*Menu Path*
Mode	Mode	Do not use, Use	Use	[Device Planning]

Global Protection Parameter of the Cold Load Pickup Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Winding Side	Winding Side	W1, W2	W1	[Protection Para /Global Prot Para /CLPU]
Mode	Mode	Bkr State, I<, Bkr State Or I<, Bkr State And I<	Bkr State	[Protection Para /Global Prot Para /CLPU]
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /CLPU]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /CLPU]
Rvs Blo	Reverse Blocking, if Reverse Blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /CLPU]
Bkr Pos Detect	Criterion by which the Breaker Switch Position is to be detected. Only available if: CLPU.Mode = I<	-.-, Bkr[1].State, Bkr[2].State	-.-	[Protection Para /Global Prot Para /CLPU]

Set Parameters of the Cold Load Pickup Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Function	Permanent activation or deactivation of module/element.	Inactive, Active	Inactive	[Protection Para /<n> /CLPU]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /CLPU]
Rvs Blo Fc	Activate (allow) or inactivate (disallow) reverse blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/element are blocked that are parameterized "Rvs Blo Fc = active".	Inactive, Active	Inactive	[Protection Para /<n> /CLPU]
t-Load Off	Select the outage time required for a load to be considered cold. If the Pickup Timer (Delay) has run out, a Cold Load Signal will be issued.	0.00 - 7200.00s	1.00s	[Protection Para /<n> /CLPU]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
t-Max Block	Select the amount of time for the cold load inrush. If the Release Timer (Delay) has run out, a Warm Load Signal will be issued.	0.00 - 300.00s	1.00s	[Protection Para /<n> /CLPU]
I<	The breaker is in the OPEN Position, if the measured current is less than this parameter.	0.01 - 1.00In	0.01In	[Protection Para /<n> /CLPU]

States of the Inputs of the Cold Load Pickup Module

Name	*Description*	*Assignment Via*
ExBlo1-I	Module Input State: External Blocking	[Protection Para /Global Prot Para /CLPU]
ExBlo2-I	Module Input State: External Blocking	[Protection Para /Global Prot Para /CLPU]
Rvs Blo-I	Module Input State: Reverse Blocking	[Protection Para /Global Prot Para /CLPU]
Bkr Pos Detect-I	Module Input State: Criterion by which the Breaker Switch Position is to be detected.	[Protection Para /Global Prot Para /CLPU]

Signals of the Cold Load Pickup Module (States of the Outputs)

Name	*Description*
Active	Signal: Active
ExBlo	Signal: External Blocking
Rvs Blo	Signal: Reverse Blocking
enabled	Signal: Cold Load enabled
detected	Signal: Cold Load detected
I<	Signal: No Load Current.

Commissioning of the Cold Load Pickup Module

Object to be tested:

Testing the *Cold Load Pickup* module according to the configured operating mode:

•I< (No current);
•Bkr state (Breaker position);
•I< (No Current) and Bkr state (Position of the breaker); and
•I< (No Current) or Bkr state (Position of the breaker).

Necessary means:

•Three-phase current source (If the Enable-Mode depends on current);

•Ampere meters (May be needed if the Enable-Mode depends on current); and

•Timer.

Test Example for Mode Bkr State (Breaker Position)

NOTICE

Mode I<: In order to test the tripping delay, start the timer and feed with an abrupt change current that is distinctly less than the I<-threshold. Measure the tripping delay. In order to measure the dropout ratio, feed a current with an abrupt change that is distinctly above the I<-threshold.

Mode I< and Bkr state: Combine the abrupt change (switching ON and OFF of the current) with the manual switching ON and OFF of the breaker.

Mode I< or Bkr state: Initially carry out the test with an abrupt changing current that is switched ON and OFF (above and below the I<-threshold). Measure the tripping times. Finally, carry out the test by manually switching the breaker ON and OFF.

•The breaker has to be in the OFF position. There must not be any load current.

•The Status Display of the device shows the signal "CLPU.ENABLED“=1.

•The Status Display of the device shows the signal ”CLPU.I<“=1.

Testing the tripping delay and the resetting ratio:

•Switch the breaker manually ON and simultaneously start the timer.

•After the the »*t Max Block (Release Delay)*« timer has expired, the signal "CPLU.Enabled “=0 has to become untrue.

•Write down the measured time.

•Manually switch the breaker OFF and simultaneously start the timer .

•After the *»t load Off«* timer has expired, the signal ”CPLU.ENABLED “=1 has to become true.

•Write down the measured time.

Successful test result:

The measured total tripping delays or individual tripping delays, threshold values, and drop-out ratios correspond with those values specified in the adjustment list. Permissible deviations/tolerances can be found under Technical Data.

ExP Protection Module – External Protection

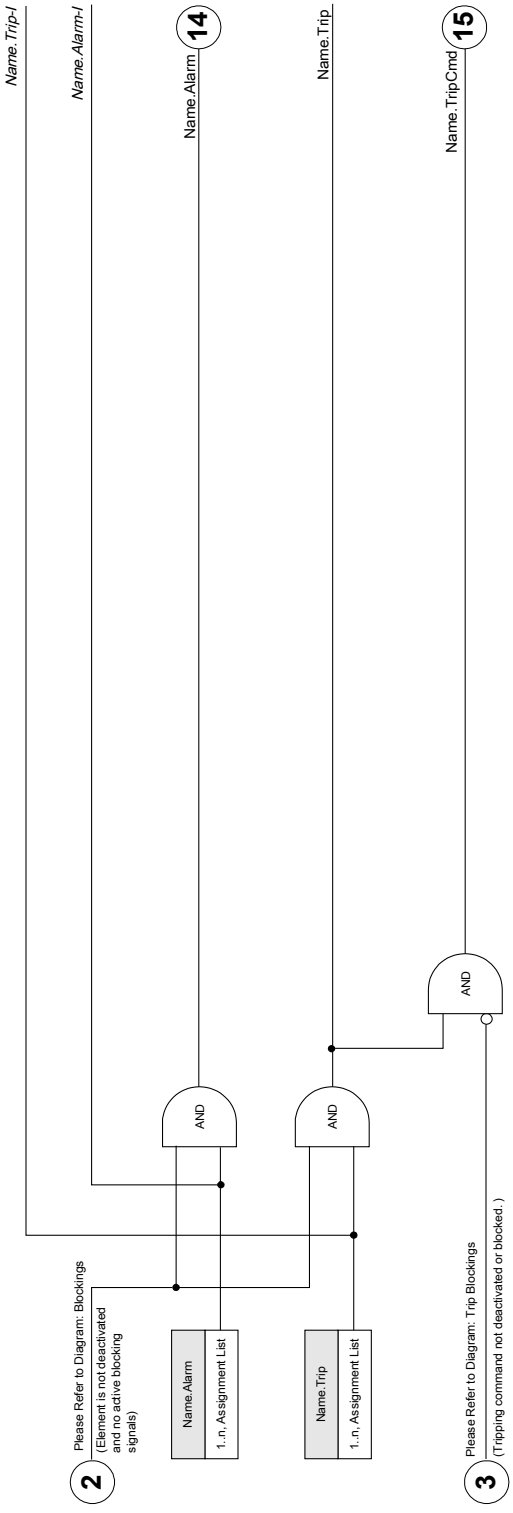
Available elements:
ExP[1] ,ExP[2] ,ExP[3] ,ExP[4]

NOTICE **All four elements of the external protection *ExP[1]...[4]* are identically structured.**

By using the module *External Protection*, the following can be incorporated into the device function: trip commands, pickups (alarms), and blockages of external protection facilities.

ExP[1]...[n]

Name = ExP[1]...[n]



Device Planning Parameters of the External Protection Module

Parameter	*Description*	*Options*	*Default*	*Menu Path*
Mode	Mode	Do not use, Use	Use	[Device Planning]

Global Protection Parameters of the External Protection Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /ExP /ExP[1]]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /ExP /ExP[1]]
ExBlo TripCmd	External blocking of the Trip Command of the module/the element, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /ExP /ExP[1]]
Alarm	Assignment for External Alarm	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /ExP /ExP[1]]
Trip	External trip of the Bkr. if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /ExP /ExP[1]]

Setting Group Parameters of the External Protection Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Function	Permanent activation or deactivation of module/element.	Inactive, Active	Inactive	[Protection Para /<n> /ExP /ExP[1]]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /ExP /ExP[1]]
Blo TripCmd	Permanent blocking of the Trip Command of the module/element.	Inactive, Active	Inactive	[Protection Para /<n> /ExP /ExP[1]]
ExBlo TripCmd Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo TripCmd Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /ExP /ExP[1]]

External Protection Module Input States

Name	*Description*	*Assignment Via*
ExBlo1-I	Module Input State: External Blocking1	[Protection Para /Global Prot Para /ExP /ExP[1]]
ExBlo2-I	Module Input State: External Blocking2	[Protection Para /Global Prot Para /ExP /ExP[1]]
ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command	[Protection Para /Global Prot Para /ExP /ExP[1]]
Alarm-I	Module Input State: Alarm	[Protection Para /Global Prot Para /ExP /ExP[1]]
Trip-I	Module Input State: Trip	[Protection Para /Global Prot Para /ExP /ExP[1]]

External Protection Module Signals (Output States)

Name	*Description*
Active	Signal: Active
ExBlo	Signal: External Blocking
Blo TripCmd	Signal: Trip Command blocked
ExBlo TripCmd	Signal: External Blocking of the Trip Command
Alarm	Signal: Alarm
Trip	Signal: Trip
TripCmd	Signal: Trip Command

Commissioning: External Protection

Object to be tested:
Test of the External Protection Module.

Necessary means:
Dependent on the application.

Procedure:
Simulate the functionality of the External Protection (pickup, trip, and blockings) by (de-)energizing the digital inputs.

Successful test result:
All external pickups, external trips, and external blockings are correctly recognized and processed by the device.

Ext Temp Superv Protection Module – External Temperature Supervision

Elements:
Ext Temp Superv[1] ,Ext Temp Superv[2] ,Ext Temp Superv[3]

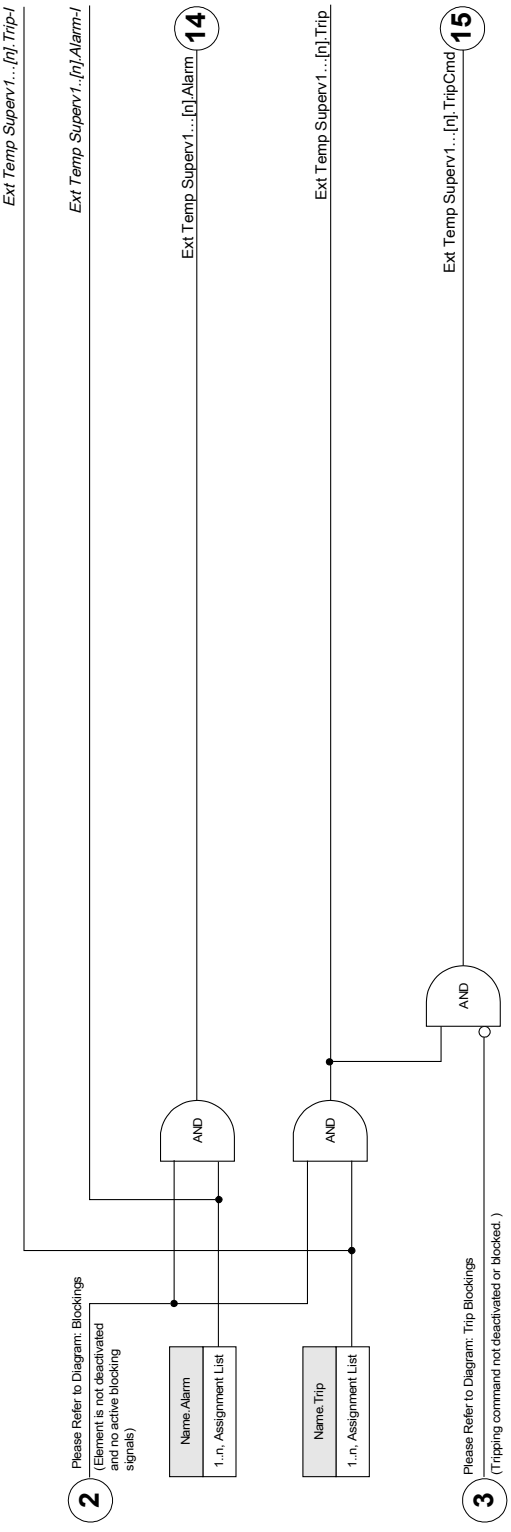
NOTICE **All elements of the external protection *Ext Temp Superv* are identically structured.**

By using the *Ext Temp Superv* module, the following can be incorporated into the device function: trip commands, alarms (pickups), and blockages of digital external temperature protection.

Since the *Ext Temp Superv* module is functionally identical to the *Ext. Protection* module, it is the User's responsibility to select the proper assignments for the settings Alarm (Pickup) and Trip for reflecting the purpose of this module.

Ext Temp Superv[1]...[n]

Name = Ext Temp Superv[1]...[n]



Device Planning Parameters of the External Temperature Supervision Module

Parameter	*Description*	*Options*	*Default*	*Menu Path*
Mode	Mode	Do not use, Use	Use	[Device Planning]

Global Protection Parameters of the External Temperature Supervision Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Temp-Prot /Ext Temp Superv[1]]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Temp-Prot /Ext Temp Superv[1]]
ExBlo TripCmd	External blocking of the Trip Command of the module/the element, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Temp-Prot /Ext Temp Superv[1]]
Alarm	Assignment for External Alarm	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Temp-Prot /Ext Temp Superv[1]]
Trip	External trip of the Bkr. if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Temp-Prot /Ext Temp Superv[1]]

Setting Group Parameters of the External Temperature Supervision Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Function	Permanent activation or deactivation of module/element.	Inactive, Active	Inactive	[Protection Para /<n> /Temp-Prot /Ext Temp Superv[1]]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /Temp-Prot /Ext Temp Superv[1]]
Blo TripCmd	Permanent blocking of the Trip Command of the module/element.	Inactive, Active	Inactive	[Protection Para /<n> /Temp-Prot /Ext Temp Superv[1]]
ExBlo TripCmd Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo TripCmd Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /Temp-Prot /Ext Temp Superv[1]]

External Temperature Supervision Module Input States

Name	*Description*	*Assignment Via*
ExBlo1-I	Module Input State: External Blocking1	[Protection Para /Global Prot Para /Temp-Prot /Ext Temp Superv[1]]
ExBlo2-I	Module Input State: External Blocking2	[Protection Para /Global Prot Para /Temp-Prot /Ext Temp Superv[1]]
ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command	[Protection Para /Global Prot Para /Temp-Prot /Ext Temp Superv[1]]
Alarm-I	Module Input State: Alarm	[Protection Para /Global Prot Para /Temp-Prot /Ext Temp Superv[1]]
Trip-I	Module Input State: Trip	[Protection Para /Global Prot Para /Temp-Prot /Ext Temp Superv[1]]

External Temperature Supervision Module Signals (Output States)

Name	*Description*
Active	Signal: Active
ExBlo	Signal: External Blocking
Blo TripCmd	Signal: Trip Command blocked
ExBlo TripCmd	Signal: External Blocking of the Trip Command
Alarm	Signal: Alarm
Trip	Signal: Trip
TripCmd	Signal: Trip Command

Commissioning: External Temperature Supervision

Object to be tested:
Test of the External Temperature Supervision module.

Necessary means:
Dependent on the application.

Procedure:
Simulate the functionality of the External Temperature Supervision (pickup, trip, blockings) by (de-)energizing of the digital inputs.

Successful test result:
All external pickups, external trips, and external blockings are correctly recognized and processed by the device.

Ext Oil Temp Protection Module – External Oil Temperature Protection

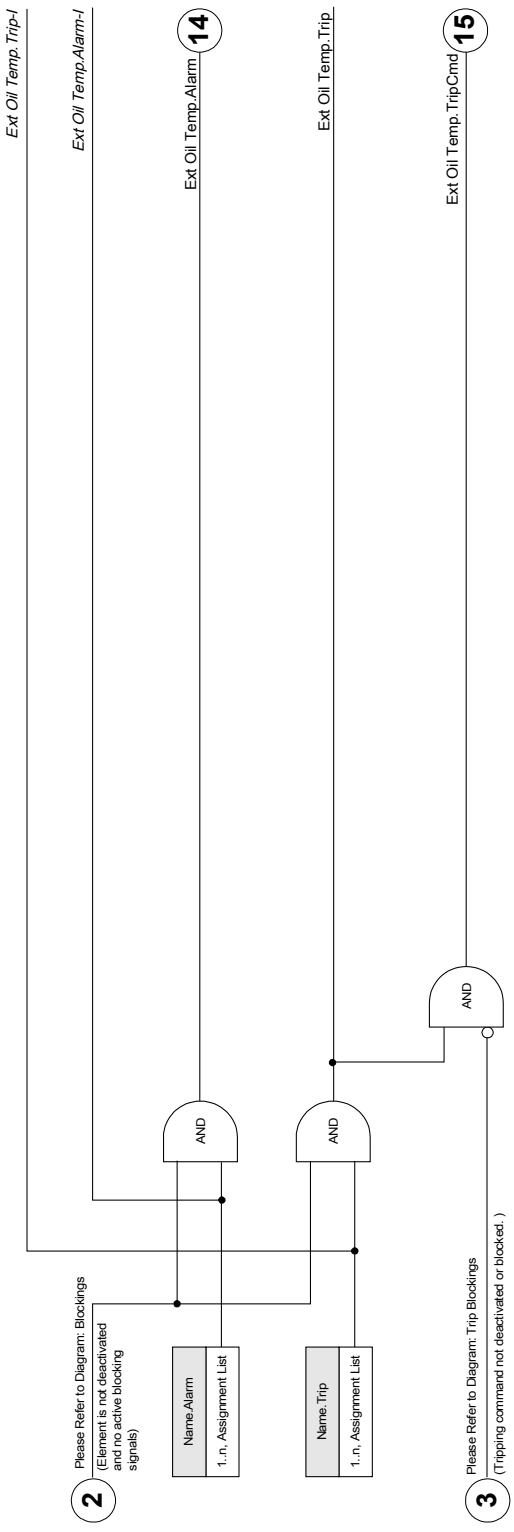
Available elements:
Ext Oil Temp

By using the *Ext Oil Temp* module, the following can be incorporated into the device function: trip commands, alarms (pickups), and blockages of digital external temperature facilities.

Since the *Ext Oil Temp* module is functionally identical to the *Ext. Protection* module, it is the User's responsibility to select the proper assignments for the settings Alarm (Pickup) and Trip for reflecting the purpose of this module.

Ext Oil Temp

Name = Ext Oil Temp



Device Planning Parameters of the External Oil Temperature Protection Module

Parameter	*Description*	*Options*	*Default*	*Menu Path*
Mode	Mode	Do not use, Use	Use	[Device Planning]

Global Protection Parameters of the External Oil Temperature Protection Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Temp-Prot /Ext Oil Temp]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Temp-Prot /Ext Oil Temp]
ExBlo TripCmd	External blocking of the Trip Command of the module/the element, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Temp-Prot /Ext Oil Temp]
Alarm	Assignment for External Alarm	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Temp-Prot /Ext Oil Temp]
Trip	External trip of the Bkr. if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Temp-Prot /Ext Oil Temp]

Setting Group Parameters of the External Oil Temperature Protection Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Function	Permanent activation or deactivation of module/element.	Inactive, Active	Inactive	[Protection Para /<n> /Temp-Prot /Ext Oil Temp]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /Temp-Prot /Ext Oil Temp]
Blo TripCmd	Permanent blocking of the Trip Command of the module/element.	Inactive, Active	Inactive	[Protection Para /<n> /Temp-Prot /Ext Oil Temp]
ExBlo TripCmd Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo TripCmd Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /Temp-Prot /Ext Oil Temp]

External Oil Temperature Protection Module Input States

Name	*Description*	*Assignment Via*
ExBlo1-I	Module Input State: External Blocking1	[Protection Para /Global Prot Para /Temp-Prot /Ext Oil Temp]
ExBlo2-I	Module Input State: External Blocking2	[Protection Para /Global Prot Para /Temp-Prot /Ext Oil Temp]
ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command	[Protection Para /Global Prot Para /Temp-Prot /Ext Oil Temp]
Alarm-I	Module Input State: Alarm	[Protection Para /Global Prot Para /Temp-Prot /Ext Oil Temp]
Trip-I	Module Input State: Trip	[Protection Para /Global Prot Para /Temp-Prot /Ext Oil Temp]

External Oil Temperature Protection Module Signals (Output States)

Name	*Description*
Active	Signal: Active
ExBlo	Signal: External Blocking
Blo TripCmd	Signal: Trip Command blocked
ExBlo TripCmd	Signal: External Blocking of the Trip Command
Alarm	Signal: Alarm
Trip	Signal: Trip
TripCmd	Signal: Trip Command

Commissioning: External Protection

Object to be tested:
Test of the External Oil Temperature Protection module.

Necessary means:
Dependent on the application.

Procedure:
Simulate the functionality of the External Oil Temperature Protection (pickup, trip, blockings) by (de-)energizing of the digital inputs.

Successful test result:
All external pickups, external trips, and external blockings are correctly recognized and processed by the device.

Sudden Pressure Protection Module – Sudden Pressure Protection

Available elements:
Sudden Press

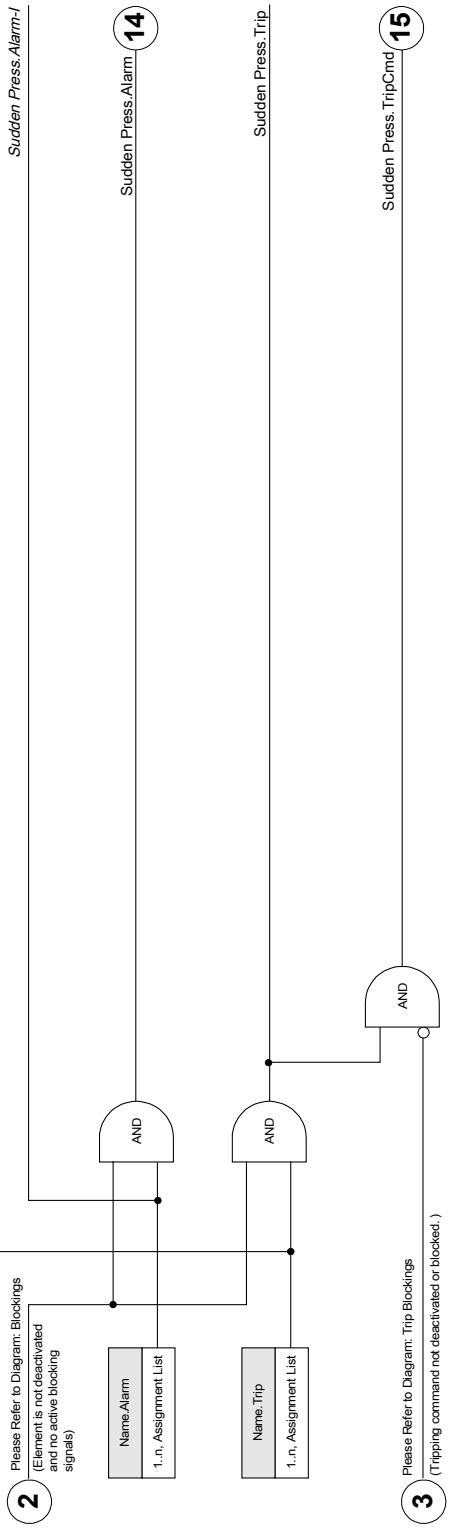
Principle – General Use

Most large size transformers (5000 KVA or above) are recommended to be equipped with a sudden pressure relay that detects rapid change in oil or gas pressure within the tank as result of internal arcing. The sudden pressure relay can detect internal faults such as turn to turn faults that other protection functions such as differential and overcurrents may not be sensitive enough to sense. The sudden pressure relay is usually equipped with output contacts that can be directly used for tripping and alarming, but it does not have recording and communication capabilities built in.

A sudden pressure protection module is provided in the protective device to take the output signals from the conventional sudden pressure relay and to form more secure and intelligent transformer protections. Through this module, the events of sudden pressure relay operations can be recorded and communicated to the control center.

Sudden Press

Name = Sudden Press



Device Planning Parameters of the Sudden Pressure Protection Module

Parameter	*Description*	*Options*	*Default*	*Menu Path*
Mode	Mode	Do not use, Use	Use	[Device Planning]

Global Protection Parameters of the Sudden Pressure Protection Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Sudden Press]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Sudden Press]
ExBlo TripCmd	External blocking of the Trip Command of the module/the element, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Sudden Press]
Alarm	Assignment for External Alarm	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Sudden Press]
Trip	External trip of the Bkr. if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Sudden Press]

Setting Group Parameters of the Sudden Pressure Protection Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Function	Permanent activation or deactivation of module/element.	Inactive, Active	Inactive	[Protection Para /<n> /Sudden Press]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /Sudden Press]
Blo TripCmd	Permanent blocking of the Trip Command of the module/element.	Inactive, Active	Inactive	[Protection Para /<n> /Sudden Press]
ExBlo TripCmd Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo TripCmd Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /Sudden Press]

Sudden Pressure Protection Module Input States

Name	*Description*	*Assignment Via*
ExBlo1-I	Module Input State: External Blocking1	[Protection Para /Global Prot Para /Sudden Press]
ExBlo2-I	Module Input State: External Blocking2	[Protection Para /Global Prot Para /Sudden Press]
ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command	[Protection Para /Global Prot Para /Sudden Press]
Alarm-I	Module Input State: Alarm	[Protection Para /Global Prot Para /Sudden Press]
Trip-I	Module Input State: Trip	[Protection Para /Global Prot Para /Sudden Press]

Sudden Pressure Protection Module Signals (Output States)

Name	*Description*
Active	Signal: Active
ExBlo	Signal: External Blocking
Blo TripCmd	Signal: Trip Command blocked
ExBlo TripCmd	Signal: External Blocking of the Trip Command
Alarm	Signal: Alarm
Trip	Signal: Trip
TripCmd	Signal: Trip Command

Commissioning: Sudden Pressure Protection

Object to be tested:
Test of the Sudden Pressure Protection module.

Necessary means:
Dependent on the application.

Procedure:
Simulate the functionality of the Sudden Protection Relay.

Successful test result:
All external pickups, external trips, and external blockings are correctly recognized and processed by the device.

BF Supervision Module – Circuit Breaker Failure Protection [ANSI 50BF]

BF[1] ,BF[2]

Principle – General Use

The breaker failure (BF) protection is used to provide backup protection in the event that a breaker fails to operate properly during fault clearing. A breaker failure condition is recognized if current is still flowing through the breaker after tripping or opening breaker commands have been issued for a specified time. The User can select different trigger modes. In addition to that, up to three additional trigger events (trip commands) can be assigned from the all protection modules.

Trigger Modes

There are three trigger modes for the breaker failure available. In addition, there are three assignable trigger inputs available.

•*All Trips*: All trip signals that are assigned to this breaker (within the breaker manager) will start the BF module.

•*Current Trips*: All current trips that are assigned to this breaker (within the breaker manager) will start the BF module.

•*External Trips*: All external trips that are assigned to this breaker (within the breaker manager) will start the BF module.

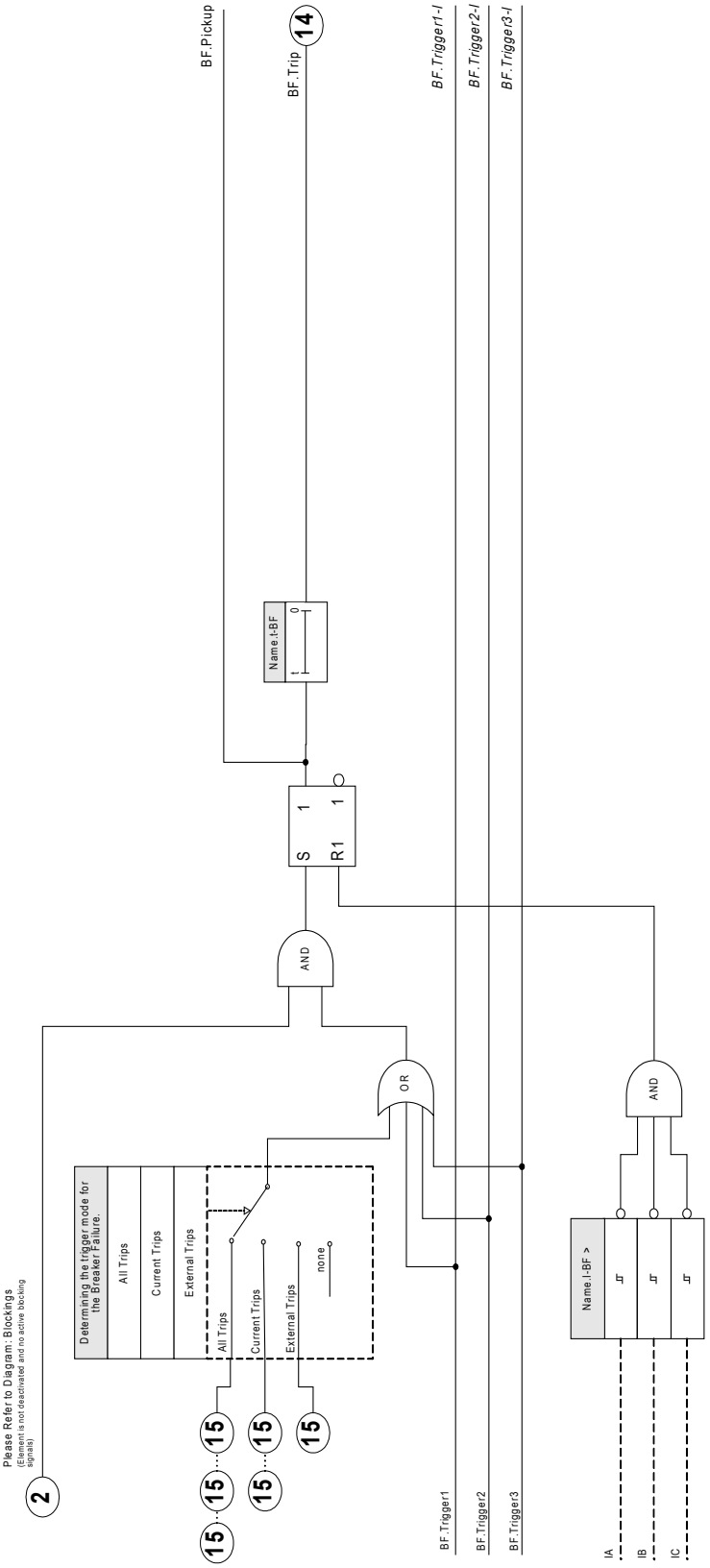
•In addition, the User can also select *none* (e.g.: if the User intends to use one of the three additional assignable trigger inputs).

NOTICE **Those trips can exclusively start the breaker failures that are assigned within the breaker manager to the breaker that is to be supervised.**

NOTICE **Select the winding side from which the measured currents should be taken in case this protective device is a transformer differential protection.**

BF

Name = BF


BF.Pickup
BF.Trip
14
BF.Trigger1-I
BF.Trigger2-I
BF.Trigger3-I
Name.t-BF
t
0
1
S
1
R1
1
AND
OR
AND
Please Refer to Diagram: Blockings
(Element is not deactivated and no active blocking signals)
2
Determining the trigger mode for the Breaker Failure.
All Trips
Current Trips
External Trips
All Trips
Current Trips
External Trips
none
15
15
15
15
15
15
BF.Trigger1
BF.Trigger2
BF.Trigger3
Name.I-BF >
IA
IB
IC

Device Planning Parameters of the BF Module

Parameter	*Description*	*Options*	*Default*	*Menu Path*
Mode	Mode	Use	Use	[Device Planning]

Global Protection Parameters of the BF Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Winding Side	Winding Side	BF[1]: W1 BF[2]: W2	BF[1]: W1 BF[2]: W2	[Protection Para /Global Prot Para /Supervision /BF[1]]
Bkr	Selection of the Breaker to be monitored.	BF[1]: Bkr[1] BF[2]: Bkr[2]	BF[1]: Bkr[1] BF[2]: Bkr[2]	[Protection Para /Global Prot Para /Supervision /BF[1]]
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Supervision /BF[1]]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Supervision /BF[1]]
Trigger	Determining the trigger mode for the Breaker Failure.	none, All Trips, Current Trips, External Trips	none	[Protection Para /Global Prot Para /Supervision /BF[1]]
Trigger1	Trigger that will start the BF	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Supervision /BF[1]]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Trigger2	Trigger that will start the BF	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Supervision /BF[1]]
Trigger3	Trigger that will start the BF	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Supervision /BF[1]]

Setting Group Parameters of the BF Module

NOTICE

In order to prevent a faulty activation of the BF Module, the pickup (alarm) time must be greater than the sum of:

- **The close-open time of the breaker (please refer to the technical data of the manufacturer of the breaker);**
- **+ The tripping delay of the device (please refer to the Technical Data section);**
- **+ The security margin; and**
- **+ The operating time.**

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Function	Permanent activation or deactivation of module/element.	Inactive, Active	Inactive	[Protection Para /<n> /Supervision /BF[1]]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /Supervision /BF[1]]
I-BF >	Current level that needs to exist after Trip Command has been given.	0.00 - 0.10In	0.00In	[Protection Para /<n> /Supervision /BF[1]]
t-BF	If the delay time is expired, an BF alarm is given out.	0.00 - 10.00s	0.20s	[Protection Para /<n> /Supervision /BF[1]]

BF Module Input States

Name	*Description*	*Assignment Via*
ExBlo1-I	Module Input State: External Blocking1	[Protection Para /Global Prot Para /Supervision /BF[1]]
ExBlo2-I	Module Input State: External Blocking2	[Protection Para /Global Prot Para /Supervision /BF[1]]
Trigger1	Module Input: Trigger that will start the BF	[Protection Para /Global Prot Para /Supervision /BF[1]]
Trigger2	Module Input: Trigger that will start the BF	[Protection Para /Global Prot Para /Supervision /BF[1]]
Trigger3	Module Input: Trigger that will start the BF	[Protection Para /Global Prot Para /Supervision /BF[1]]

BF Module Signals (Output States)

Name	*Description*
Active	Signal: Active
ExBlo	Signal: External Blocking
Pickup	Signal: BF-Module Started (Pickup)
Trip	Signal: Breaker Failure Trip

BF Module Trigger Functions

These trips will start the BF module if all trips have been selected as the trigger event.

Name	*Description*
-.-	No assignment
87.TripCmd	Signal: Trip Command
87H.TripCmd	Signal: Trip Command
87GD[1].TripCmd	Signal: Trip Command
87GDH[1].TripCmd	Signal: Trip Command
87GD[2].TripCmd	Signal: Trip Command

Name	*Description*
87GDH[2].TripCmd	Signal: Trip Command
50P[1].TripCmd	Signal: Trip Command
50P[2].TripCmd	Signal: Trip Command
50P[3].TripCmd	Signal: Trip Command
50P[4].TripCmd	Signal: Trip Command
51P[1].TripCmd	Signal: Trip Command
51P[2].TripCmd	Signal: Trip Command
51P[3].TripCmd	Signal: Trip Command
51P[4].TripCmd	Signal: Trip Command
50X[1].TripCmd	Signal: Trip Command
50X[2].TripCmd	Signal: Trip Command
51X[1].TripCmd	Signal: Trip Command
51X[2].TripCmd	Signal: Trip Command
50R[1].TripCmd	Signal: Trip Command
50R[2].TripCmd	Signal: Trip Command
51R[1].TripCmd	Signal: Trip Command
51R[2].TripCmd	Signal: Trip Command
ZI[1].TripCmd	Signal: Zone Interlocking Trip Command
ZI[2].TripCmd	Signal: Zone Interlocking Trip Command
49.TripCmd	Signal: Trip Command
51Q[1].TripCmd	Signal: Trip Command
51Q[2].TripCmd	Signal: Trip Command
ExP[1].TripCmd	Signal: Trip Command
ExP[2].TripCmd	Signal: Trip Command
ExP[3].TripCmd	Signal: Trip Command
ExP[4].TripCmd	Signal: Trip Command
Sudden Press.TripCmd	Signal: Trip Command
Ext Oil Temp.TripCmd	Signal: Trip Command
Ext Temp Superv[1].TripCmd	Signal: Trip Command
Ext Temp Superv[2].TripCmd	Signal: Trip Command
Ext Temp Superv[3].TripCmd	Signal: Trip Command
RTD.TripCmd	Signal: Trip Command

These trips will start the BF module if all current functions have been selected as the trigger event.

Name	*Description*
-.-	No assignment
87.TripCmd	Signal: Trip Command
87H.TripCmd	Signal: Trip Command
87GD[1].TripCmd	Signal: Trip Command
87GDH[1].TripCmd	Signal: Trip Command
87GD[2].TripCmd	Signal: Trip Command
87GDH[2].TripCmd	Signal: Trip Command
50P[1].TripCmd	Signal: Trip Command
50P[2].TripCmd	Signal: Trip Command
50P[3].TripCmd	Signal: Trip Command
50P[4].TripCmd	Signal: Trip Command
51P[1].TripCmd	Signal: Trip Command
51P[2].TripCmd	Signal: Trip Command
51P[3].TripCmd	Signal: Trip Command
51P[4].TripCmd	Signal: Trip Command
50X[1].TripCmd	Signal: Trip Command
50X[2].TripCmd	Signal: Trip Command
51X[1].TripCmd	Signal: Trip Command
51X[2].TripCmd	Signal: Trip Command
50R[1].TripCmd	Signal: Trip Command
50R[2].TripCmd	Signal: Trip Command
51R[1].TripCmd	Signal: Trip Command
51R[2].TripCmd	Signal: Trip Command
ZI[1].TripCmd	Signal: Zone Interlocking Trip Command
ZI[2].TripCmd	Signal: Zone Interlocking Trip Command
49.TripCmd	Signal: Trip Command
51Q[1].TripCmd	Signal: Trip Command
51Q[2].TripCmd	Signal: Trip Command

These trips will start the BF module if external trips have been selected as the trigger event.

Name	*Description*
-.-	No assignment
ExP[1].TripCmd	Signal: Trip Command
ExP[2].TripCmd	Signal: Trip Command
ExP[3].TripCmd	Signal: Trip Command
ExP[4].TripCmd	Signal: Trip Command
Sudden Press.TripCmd	Signal: Trip Command
Ext Oil Temp.TripCmd	Signal: Trip Command
Ext Temp Superv[1].TripCmd	Signal: Trip Command
Ext Temp Superv[2].TripCmd	Signal: Trip Command
Ext Temp Superv[3].TripCmd	Signal: Trip Command

Commissioning: Circuit Breaker Failure Protection [ANSI 50BF]

NOTICE **The time that is configured for the BF MUST NOT be below the breaker control time, otherwise an unwanted operation of the BF is caused by any protective trip.**

Object to Be Tested:

Test of the breaker failure protection.

Necessary Means:

- Current source;
- Current meter; and
- Timer.

NOTICE **When testing, the applied test current must always be higher than the tripping threshold *»I-BF«*. If the test current falls below the threshold while the breaker is in the "Off" position, no pickup will be generated.**

Procedure (Single-Phase):

For testing the tripping time of the BF protection, a test current has to be higher than the threshold value of one of the current protection modules that are assigned to trigger the BF protection. The BF trip delay can be measured from the time when one of the triggering inputs becomes active to the time when the BF protection trip is asserted.

To avoid wiring errors, checked to make sure the breaker in the upstream system switches off.

The time, measured by the timer, should be in line with the specified tolerances.

WARNING **Re-connect the control cable to the breaker!**

Successful Test Result:

The actual times measured comply with the setpoint times. The circuit breaker in the higher-level section switches off.

TCM-Supervision Module – Trip Circuit Monitoring [74TC]

TCM[1] ,TCM[2]

The trip circuit monitoring is used for monitoring if the trip circuit is ready for opening operations. The monitoring can be fulfilled by two ways. The one way assumes only 52a is used in the trip circuit and other assumes besides 52a, 52b is also used for the circuit monitoring. Two options either 52a only (or breaker closed) or both (52a and 52b) are provided for the User to select based on use of the breaker status in the trip circuit. With 52a only in the trip circuit, the monitoring is only effective when the breaker is closed while if both 52a and 52b are used, the trip circuit will be monitored all time as long as the control power is on.

The trip circuit continuity is monitored through the digital inputs DI1 and DI2, and the breaker status 52a or 52b or both must be monitored through the other digital inputs. For transformer protection, if the User wants to monitor both breakers, it is recommended to use the breaker closed option (52a), because the Either (breaker open or closed) will consume at least four digital inputs for this application only. Plus 52a and 52b on both breakers, there would be nothing left for other protection function use. Note that the digital inputs used for this purpose must be configured properly based on the trip circuit control voltage and also that the de-bouncing times must be set to minimum. If the trip circuit is detected broken, an alarm will be issued with a specified delay, which must be greater than a period from the time when a trip contact is closed to the time when the breaker status is clearly recognized by the relay.

NOTICE **In Slot 1 has two digital inputs, each of which has a separate root (contact separation) for the trip circuit supervision.**

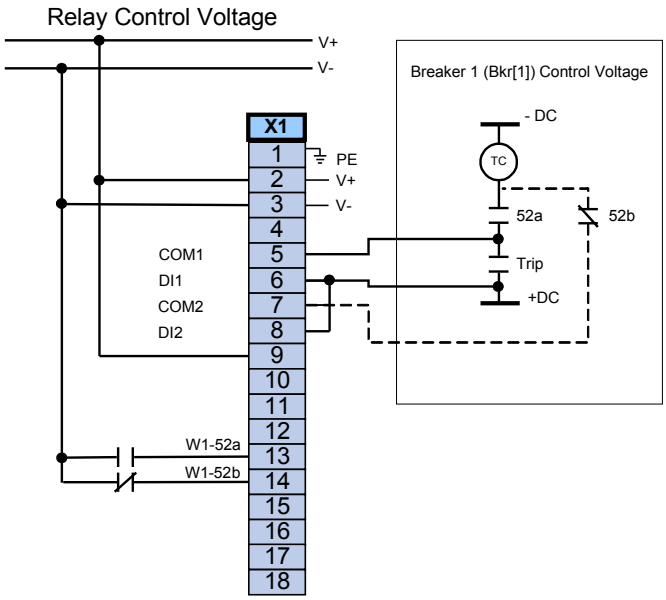
In this case, the trip circuit supply voltage serves also as supply voltage for the digital inputs and so the supply voltage failure of a trip circuit can be detected directly.

In order to identify a conductor failure in the trip circuit on the supply line or in the trip coil, the off-coil has to be looped-in to the supervision circuit.

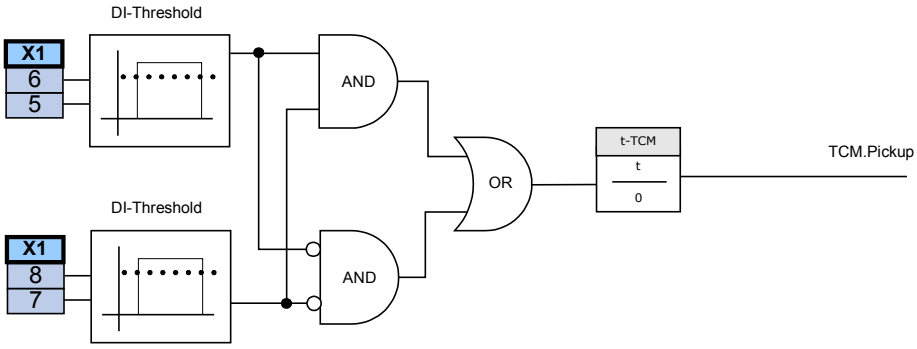
The time delay is to be set in a way that switching actions cannot cause false trips in this module.

One Breaker Application Examples

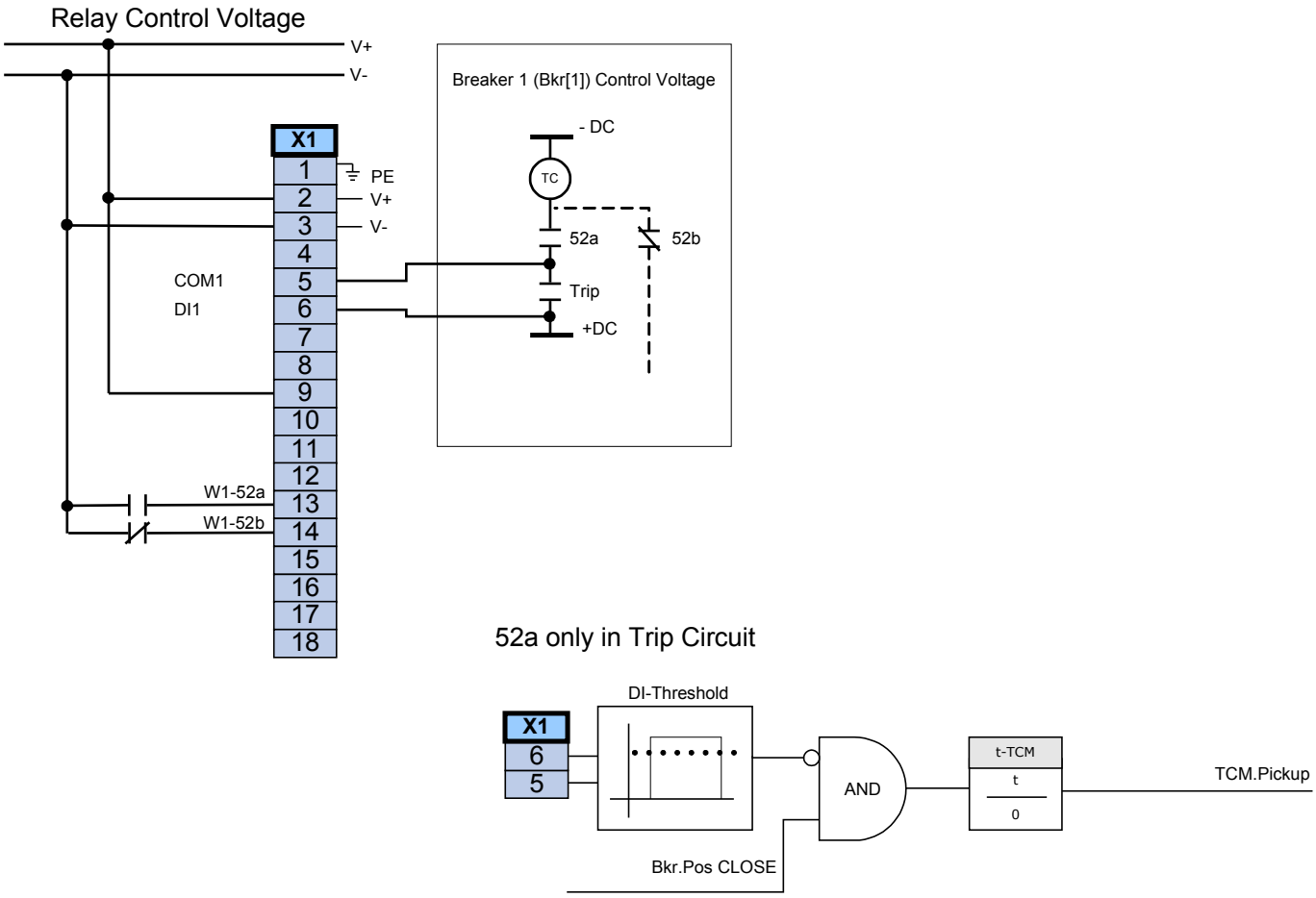
Trip Circuit Monitoring for one Breaker: Auxiliary Contacts (52a and 52b) in trip circuit.



52a and 52b in Trip Circuit

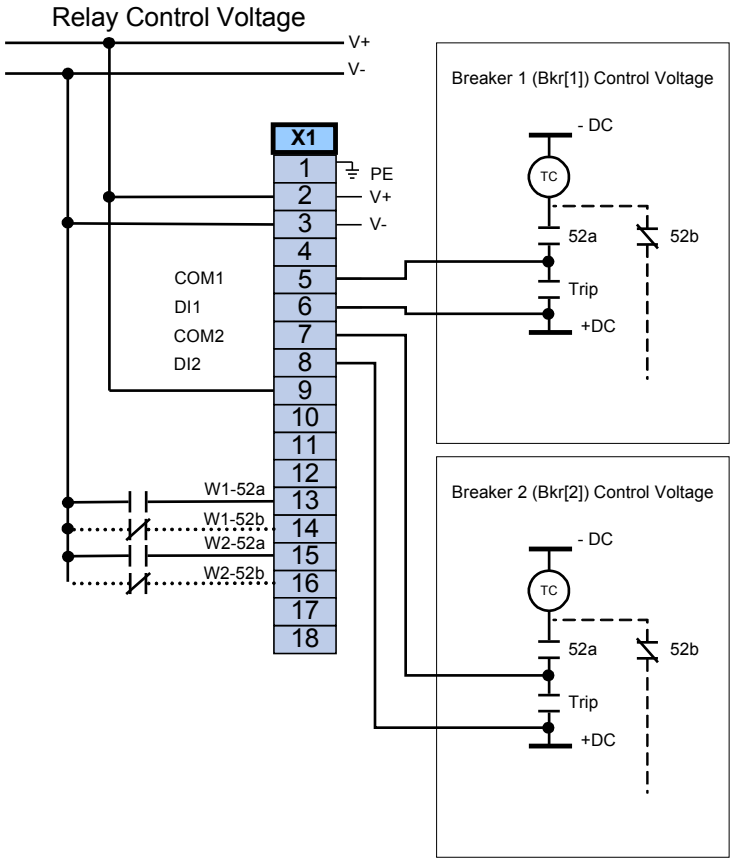


Trip Circuit Monitoring for One Breaker: Auxiliary Contacts (52a Only) in Trip Circuit.

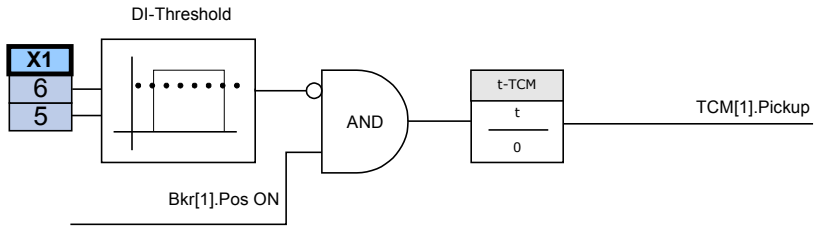


Two Breaker Application Example

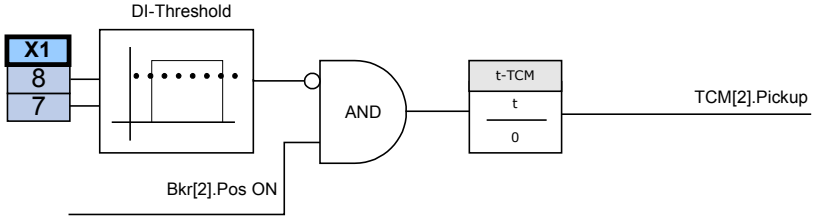
Trip Circuit Monitoring for Two Breakers: Auxiliary Contacts (52a Only) in Trip Circuits.



52a only in Trip Circuit



52a only in Trip Circuit



Device Planning Parameters of the Trip Circuit Monitoring Module

Parameter	*Description*	*Options*	*Default*	*Menu Path*
Mode	Mode	Do not use, Use	Use	[Device Planning]

Global Protection Parameters of the Trip Circuit Monitoring Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Bkr Pos Detect	Criterion by which the Breaker Switch Position is to be detected.	TCM[1]: Bkr[1].State TCM[2]: Bkr[2].State	TCM[1]: Bkr[1].State TCM[2]: Bkr[2].State	[Protection Para /Global Prot Para /Supervision /TCM[1]]
Mode	Mode	Closed, Either	Closed	[Protection Para /Global Prot Para /Supervision /TCM[1]]
Input 1	Select the input configured to monitor the trip coil when the breaker is closed.	-.-, DI Slot X1.DI 1, DI Slot X1.DI 2, DI Slot X1.DI 3, DI Slot X1.DI 4, DI Slot X1.DI 5, DI Slot X1.DI 6, DI Slot X1.DI 7, DI Slot X1.DI 8	TCM[1]: DI Slot X1.DI 1 TCM[2]: DI Slot X1.DI 2	[Protection Para /Global Prot Para /Supervision /TCM[1]]
Input 2	Select the input configured to monitor the trip coil when the breaker is open. Only available if Mode set to “Either”. Only available if: Mode = Either	-.-, DI Slot X1.DI 1, DI Slot X1.DI 2, DI Slot X1.DI 3, DI Slot X1.DI 4, DI Slot X1.DI 5, DI Slot X1.DI 6, DI Slot X1.DI 7, DI Slot X1.DI 8	-.-	[Protection Para /Global Prot Para /Supervision /TCM[1]]
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Supervision /TCM[1]]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Supervision /TCM[1]]

Setting Group Parameters of the Trip Circuit Monitoring Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Function	Permanent activation or deactivation of module/element.	Inactive, Active	Inactive	[Protection Para /<n> /Supervision /TCM[1]]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /Supervision /TCM[1]]
t-TCM	Tripping delay time of the Trip Circuit Supervision	0.10 - 10.00s	0.2s	[Protection Para /<n> /Supervision /TCM[1]]

Trip Circuit Monitoring Module Input States

Name	*Description*	*Assignment Via*
CinBkr-52a	Position indicator/check-back signal of the Bkr (52a)	[Protection Para /Global Prot Para /Supervision /TCM[1]]
CinBkr-52b	Module Input State: Position indicator/check-back signal of the Bkr. (52b)	[Protection Para /Global Prot Para /Supervision /TCM[1]]
ExBlo1-I	Module Input State: External Blocking1	[Protection Para /Global Prot Para /Supervision /TCM[1]]
ExBlo2-I	Module Input State: External Blocking2	[Protection Para /Global Prot Para /Supervision /TCM[1]]
Bkr Pos Detect-I	Module Input State: Criterion by which the Breaker Switch Position is to be detected.	[Protection Para /Global Prot Para /Supervision /TCM[1]]

Trip Circuit Monitoring Module Signals (Output States)

Name	*Description*
Active	Signal: Active
ExBlo	Signal: External Blocking
Pickup	Signal: Pickup Trip Circuit Supervision
Not Possible	Not possible because no state indicator assigned to the breaker.

Commissioning: Trip Circuit Monitoring for Breakers [74TC]

NOTICE **For breakers that trip by means of little energy (e.g.: via an optocoupler), it has to be ensured that the current applied by the digital inputs will not cause false tripping of the breaker.**

Object to Be Tested:
Test of the trip circuit monitoring (with 52a and 52b contact).

Procedure, Part 1:
Simulate failure of the control voltage in the power circuits.

Successful Test Result, Part 1:
After expiration of *»t-TCM«* the trip circuit supervision, *TCM* of the device should signal an alarm.

Procedure, Part 2:
Simulate a broken cable in the breaker control circuit.

Successful Test Result, Part 2:
After expiration of *»t-TCM«,* the trip circuit supervision *TCM* of the device should signal an alarm.

CTS-Supervision Module – Current Transformer Supervision

CTS[1] ,CTS[2]

Most functions of metering, protection, and control in the relay rely on correct current measurements. It is important to make sure the CT connections and their operations are correct. The failures (including CT secondary wire broken, insulation broken down, broken wiring between CT and relay, and mismatched polarities) will cause the incorrect current measurements. The other CT errors (due to the magnetizing current that is proportional to the primary current, CT saturation and measuring circuit and quantization error) can also cause inaccurate current measurements.

The CTS utilizes the Kirchhoff's current law to detect a CT failure and can differentiate the wiring errors from the measurement errors by adding biases to offset the measurement related errors. The biases include two terms, one of which is related to the static error that accounts for CT magnetizing characteristic differences and current measurement circuit calibration errors and other is the dynamic error that is proportional to the measured maximum current due to CT transformation characteristics. The CTs are assumed to be used in the wye-grounded winding sides. Under normal conditions, the mismatch between the calculated and the measured zero sequence current should be less than the bias value. However, if there is a CT wiring error, such relationship will not hold true. If the mismatch exceeds the bias for a specified time, an alarm will be generated.

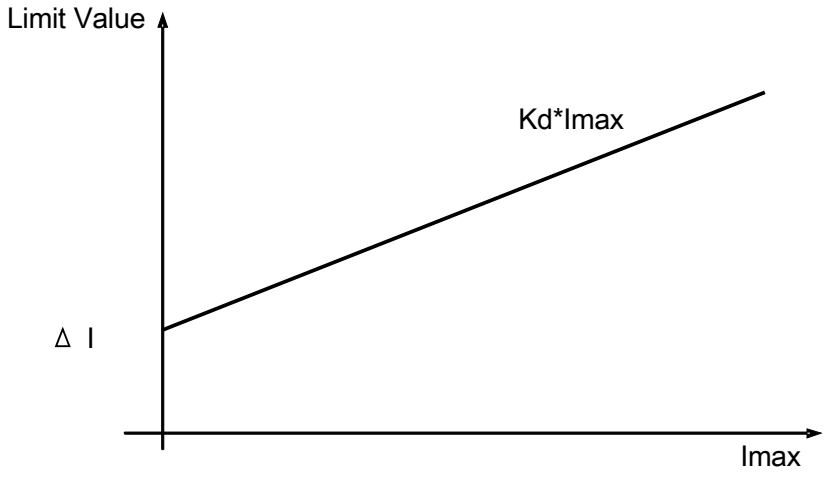
The operating principle can be expressed in terms of CT secondary currents as follow:

$$(\vec{IL}1+\vec{IL}2+\vec{IL}3)+KI*\vec{I}G=3*I_0+KI*\vec{IG}\geq\Delta I+Kd*Imax$$

KI is the ratio of the ground CT ratio over the phase CT ratio, and it is automatically calculated from the rated system parameters.

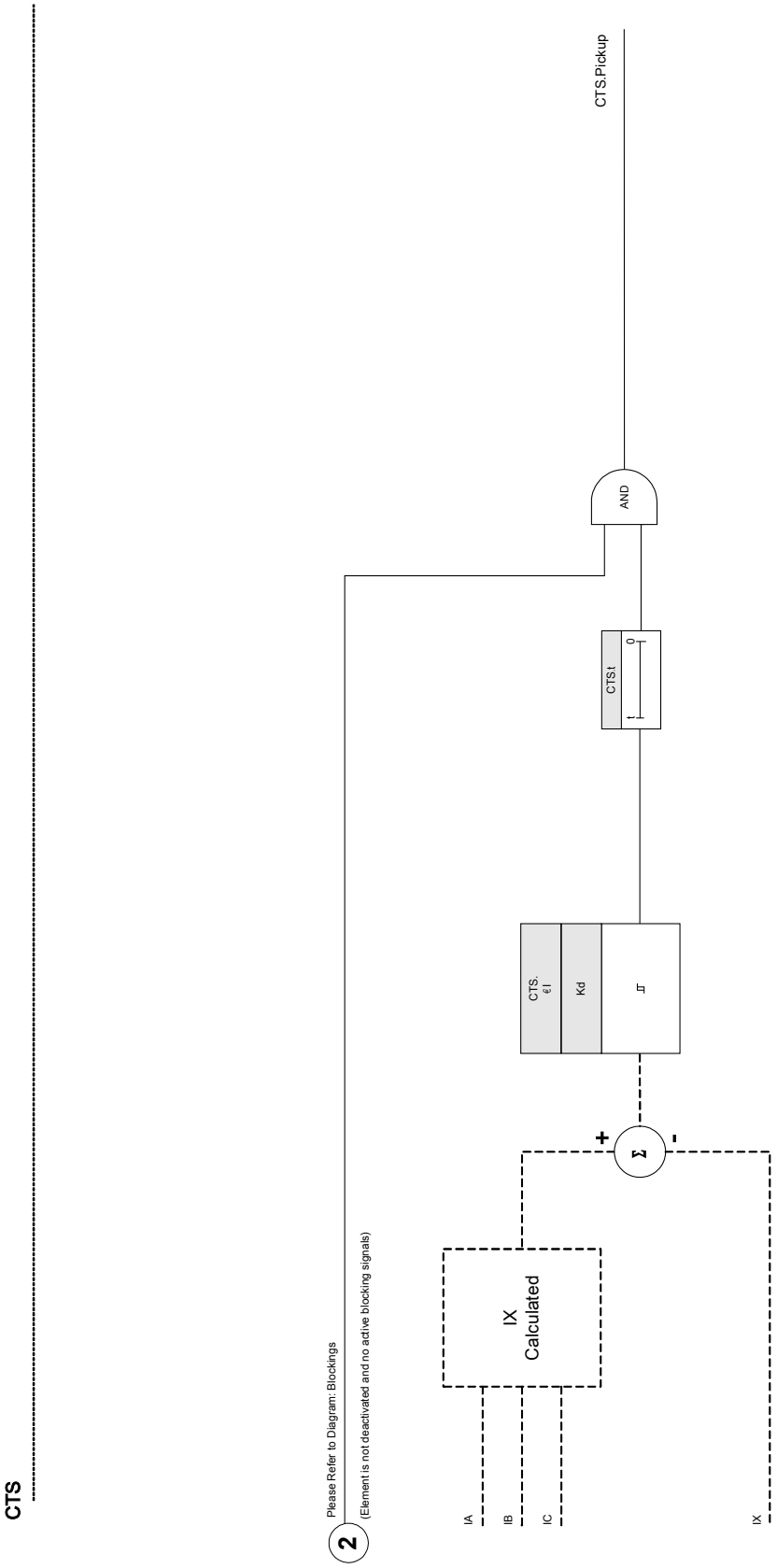
ΔI	=	The static error, a minimum mismatch allowed between the calculated and measured zero sequence current.
Kd	=	The dynamic error factor, a restrain slope that defines a percentage error generated by a high current.
Imax	=	maximum phase current.
Total bias value	=	ΔI + Kd x Imax.

The current transformer supervision operation can be graphically represented as follows.



CAUTION

If the current is measured in two phases only (for example only IA/IB) or if there is no separate ground current measuring (e.g.: normally via a zero sequence CT), the supervision function should be deactivated.


CTS
Please Refer to Diagram: Blockings
(Element is not deactivated and no active blocking signals)
2
IA
IB
IC
IX Calculated
IX
+
Σ
-
CTS. ∈ I
Kd
CTS.t
t
0
AND
CTS.Pickup

Device Planning Parameters of the Current Transformer Supervision

Parameter	*Description*	*Options*	*Default*	*Menu Path*
Mode	Mode	Do not use, Use	Do not use	[Device Planning]

Global Protection Parameter of the Current Transformer Supervision

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Winding Side	Winding Side	CTS[1]: W1 CTS[2]: W2	CTS[1]: W1 CTS[2]: W2	[Protection Para /Global Prot Para /Supervision /CTS[1]]
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Supervision /CTS[1]]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Supervision /CTS[1]]

Setting Group Parameters of the Current Transformer Supervision

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Function	Permanent activation or deactivation of module/element.	Inactive, Active	Inactive	[Protection Para /<n> /Supervision /CTS[1]]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /Supervision /CTS[1]]
ΔI	In order to prevent faulty tripping of phase selective protection functions that use the current as tripping criterion. If the difference of the measured ground current and the calculated value I0 is higher than the pick up value ΔI, an pickup event is generated after expiring of the excitation time. In such a case, a fuse failure, a broken wire or a faulty measuring circuit can be assumed.	0.10 - 1.00In	0.50In	[Protection Para /<n> /Supervision /CTS[1]]
Pickup delay	Pickup delay	0.1 - 9999.0s	1.0s	[Protection Para /<n> /Supervision /CTS[1]]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Kd	Dynamic correction factor for the evaluation of the difference between calculated and measured ground current. This correction factor allows transformer faults, caused by higher currents, to be compensated.	0.00 - 0.99	0.00	[Protection Para /<n> /Supervision /CTS[1]]

Current Transformer Supervision Input States

Name	*Description*	*Assignment Via*
ExBlo1-I	Module Input State: External Blocking1	[Protection Para /Global Prot Para /Supervision /CTS[1]]
ExBlo2-I	Module Input State: External Blocking2	[Protection Para /Global Prot Para /Supervision /CTS[1]]

Current Transformer Supervision Signals (Outputs States)

Name	*Description*
Active	Signal: Active
ExBlo	Signal: External Blocking
Pickup	Signal: Pickup Current Transformer Measuring Circuit Supervision

Commissioning: Current Transformer Failure Supervision

NOTICE

Precondition:
1.Measurement of all three-phase currents (are applied to the measuring inputs of the device).
2.The ground current is detected via a zero sequence transformer (not in residual connection).

Object to Be Tested:
Check of the CT Supervision (by comparing the calculated with the measured ground current).

Necessary Means: Three-phase current source.

Procedure, Part 1:
•Set the limiting value of the CTs to *»delta I=0.1*In«*.
•Feed a three-phase, symmetrical current system (approx. nominal current) to the secondary side.
•Disconnect the current of one phase from one of the measuring inputs (the symmetrical feeding at the secondary side has to be maintained).
•Make sure that the »CTS.ALARM« signal is generated.

Successful Test Result, Part 1: The »CTS.ALARM« signal is generated.

Procedure, Part 2:
- Feed a three-phase, symmetrical current system (approx. nominal current) to the secondary side.
- Feed a current that is higher than the threshold value for the measuring circuit supervision to the ground current measuring input.
- Make sure that the »CTS.ALARM« signal is generated.

Successful Test Result, Part 2:
The »CTS.ALARM« signal is generated.

IRIG-B00X

IRIG-B

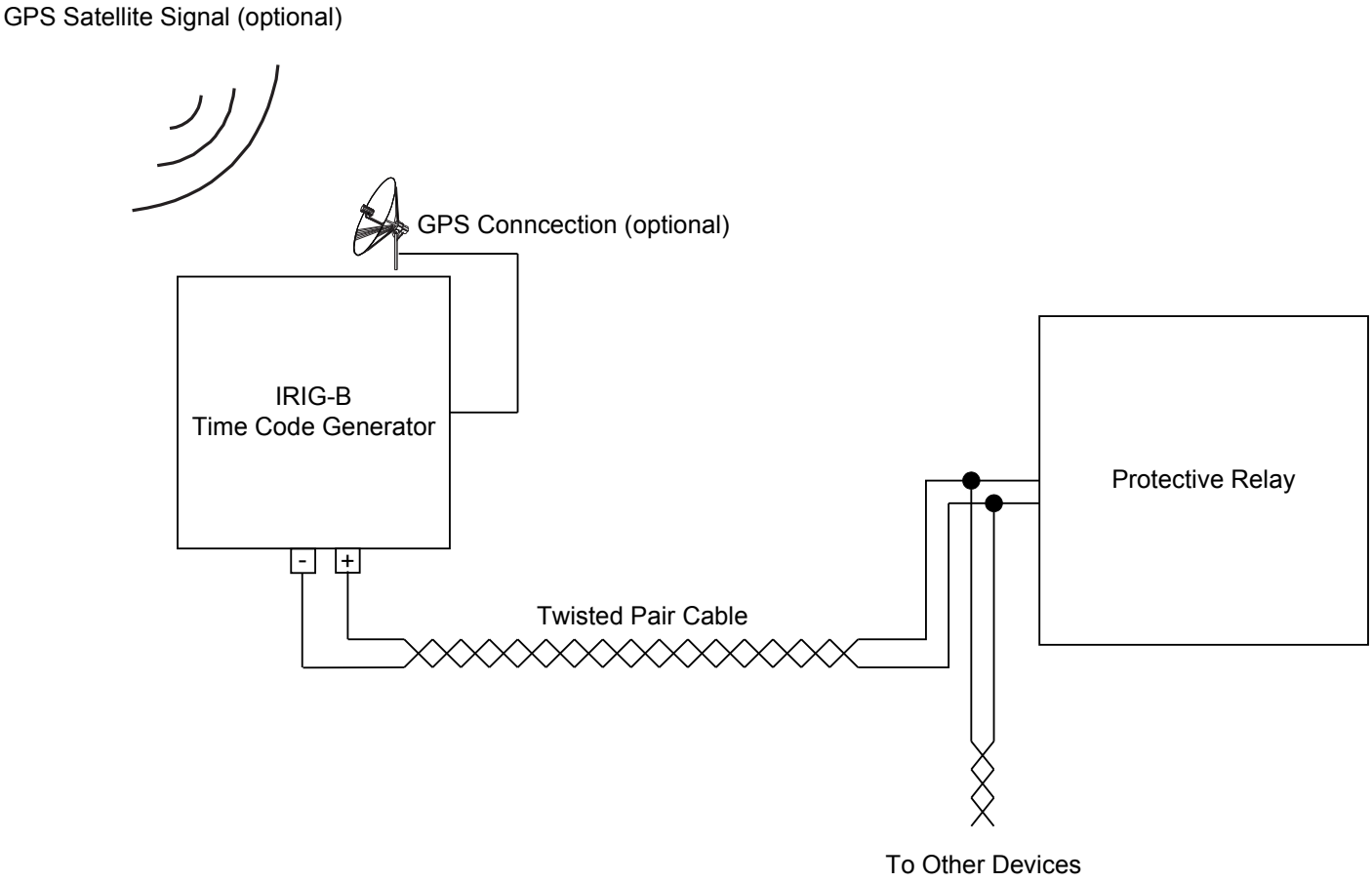
NOTICE

Requirement: A IRIG-B00X time code receiver is needed. IRIG-B004 and higher will support/transmit the "year" information.

If you are using an IRIG time code that does not support the "year" information (IRIG-B000, IRIG-B001, IRIG-B002, IRIG-B003), you have to set the "year" manually within the device. In these cases the correct year information is a precondition for a properly working IRIG-B.

Principle - General Use

This standard is the most used standard to synchronize the time of protection devices in medium voltage applications.



Based on the IRIG STANDARD 200-04, the device interface and software provides all time synchronization formats IRIG-B00X (IRIG-B000 / B001 / B002 / B003 / B004 / B005 / B006 / B007) as described in the standard. IRIG-B004 and higher will support/transmit the "year" information.

Time code B has a time frame of 1 second with an index count of 10 milliseconds and contains time-of-year and year information in a binary code decimal (BCD) format, and seconds-of-day in straight binary seconds (SBS) format.

Time accuracy of ±1ms is a requirement to synchronize the different protection devices.

The location of the IRIG-B interface depends to the device type. Please see the wiring diagram supplied with the protective device.

Function

The following IRIG-B parameters can be set within the Device Parameters menu.

- Set the IRIG-B type (choose B000 through B007).
- Set the time synchronization via IRIG-B to Active or Inactive.
- Set the time zone parameter (choose one of the 36 UTC Time Zones).
- Activate or deactivate the “Daylight Savings Time” function.

NOTICE **Parameter for Daylight Savings Time (summer-winter time) has to be set manually.**

Check the wiring (wiring error) if no IRIG signal can be detected.

A signal will be issued if no IRIG-B time code is received for longer than 60 s.

IRIG-B Control Commands

In addition to the date and time information, the IRIB-B code offers the option to transmit up to 18 control commands that can be processed by the protective device. They have to be set and issued by the Time Code Generator.

The protective devices offer up to 18 IRIG-B assignment options for those control commands in order to carry out the assigned action. That means if the IRIG-B time code is fed with the corresponding state of those control commands, than they can be used for further processing within the devices (e.g.: in order to start statistics, switch on or off street lighting).

Device Planning Parameters of the IRIG-B00X

Parameter	*Description*	*Options*	*Default*	*Menu Path*
Mode	Mode	Do not use, Use	Use	[Device Planning]

Direct Commands of the IRIG-B00X

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Res IRIG-B Cr	Resetting of the Diagnosis Counters: IRIG-B	Inactive, Active	Inactive	[Operation /Reset]

Global Protection Parameters of the IRIG-B00X

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Function	Permanent activation or deactivation of module/element.	Inactive, Active	Inactive	[Device Para /IRIG-B]
IRIG-B00X	Determination of the Type: IRIG-B00X. IRIG-B types differ in types of included “Coded Expressions” (year, control-functions, straight-binary-seconds).	IRIB-000, IRIB-001, IRIB-002, IRIB-003, IRIB-004, IRIB-005, IRIB-006, IRIB-007	IRIB-000	[Device Para /IRIG-B]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Time Zones	Time Zones	UTC+14 Kiritimati, UTC+13 Rawaki, UTC+12.75 Chatham Island, UTC+12 Wellington, UTC+11.5 Kingston, UTC+11 Port Vila, UTC+10.5 Lord Howe Island, UTC+10 Sydney, UTC+9.5 Adelaide, UTC+9 Tokyo, UTC+8 Hong Kong, UTC+7 Bangkok, UTC+6.5 Rangoon, UTC+6 Colombo, UTC+5.75 Kathmandu, UTC+5.5 New Delhi, UTC+5 Islamabad, UTC+4.5 Kabul, UTC+4 Abu Dhabi, UTC+3.5 Tehran, UTC+3 Moscow, UTC+2 Athens, UTC+1 Berlin, UTC+0 London, UTC-1 Azores, UTC-2 Fern. d. Noronha, UTC-3 Buenos Aires, UTC-3.5 St. John's, UTC-4 Santiago, UTC-5 New York, UTC-6 Chicago, UTC-7 Salt Lake City, UTC-8 Los Angeles, UTC-9 Anchorage, UTC-9.5 Taiohae, UTC-10 Honolulu, UTC-11 Midway Islands	UTC+0 London	[Device Para /IRIG-B]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Daylight Saving Time	Daylight Saving Time	Inactive, Active	Inactive	[Device Para /IRIG-B]

Signals of the IRIG-B00X (Output States)

Name	*Description*
Active	Signal: Active
Inverted	Signal: IRIG-B inverted
Control Signal1	Signal: IRIG-B Control Signal
Control Signal2	Signal: IRIG-B Control Signal
Control Signal4	Signal: IRIG-B Control Signal
Control Signal5	Signal: IRIG-B Control Signal
Control Signal6	Signal: IRIG-B Control Signal
Control Signal7	Signal: IRIG-B Control Signal
Control Signal8	Signal: IRIG-B Control Signal
Control Signal9	Signal: IRIG-B Control Signal
Control Signal10	Signal: IRIG-B Control Signal
Control Signal11	Signal: IRIG-B Control Signal
Control Signal12	Signal: IRIG-B Control Signal
Control Signal13	Signal: IRIG-B Control Signal
Control Signal14	Signal: IRIG-B Control Signal
Control Signal15	Signal: IRIG-B Control Signal
Control Signal16	Signal: IRIG-B Control Signal
Control Signal17	Signal: IRIG-B Control Signal
Control Signal18	Signal: IRIG-B Control Signal

IRIG-B00X Values

Value	*Description*	*Default*	*Size*	*Menu Path*
NoOfFramesOK	Total number valid Frames.	0	0 - 65535	[Operation /Count and RevData /IRIG-B]
NoOfFrameErrors	Total Number of Frame Errors. Physically corrupted Frame.	0	0 - 65535	[Operation /Count and RevData /IRIG-B]
Edges	Edges	0	0 - 65535	[Operation /Count and RevData /IRIG-B]

Device Parameters

Sys

Date and Time

In the *»Device parameters/Date/Time«* menu, the User can set the date and time.

Synchronize Date and Time Via PowePort-E

- If PowerPort-E is not running, please start the application.
- If device data have not been downloaded recently, click »Receive Data From The Device« in the »Device« menu.
- Double click the »Device parameters« icon in the navigation tree.
- Double click the »Date/time« icon within the operational data.
- Out of the working window, the User can now synchronize the date and time of the device with your PC (i.e.: That means that the device accepts the date and time from your PC).

Version

Within the*»Device parameters/Version« menu, the User* can obtain information on the soft- and hardware versions.

Version Via PowerPort-E

Within the *»File/Properties« menu, the User* can obtain detailed information on the currently opened file (e.g.: soft- and hardware version).

NOTICE **In order to be able to transmit a parameter file (e.g.: created off line) into the device, the following parameters must agree:**

- **Type Code (written on the top of the device/type label); and**
- **Version of the device model (can be found in the »Device Parameters\Version« menu).**

TCP/IP Settings

Within menu *»Device Para / TCP/IP«* the TCP/IP settings have to be set.

The first-time setting of the TCP/IP Parameters can be done at the panel (HMI) only.

NOTICE

Establishing a connection via TCP/IP to the device is only possible if your device is equipped with an Ethernet Interface (RJ45).

Contact your IT administrator in order to establish the network connection.

Set the TCP/IP Parameters

Call up *»Device parameter/TCP/IP«* at the HMI (panel) and set the following parameters:

- TCP/IP address;
- Subnetmask; abd
- Gateway.

Direct Commands of the System Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Ack LED	All acknowledgeable LEDs will be acknowledged.	Inactive, Active	Inactive	[Operation /Reset]
Ack RO	All acknowledgeable Relay Outputs will be acknowledged.	Inactive, Active	Inactive	[Operation /Reset]
Ack Comm	Communication will be acknowledged.	Inactive, Active	Inactive	[Operation /Reset]
Ack RO LED Comm TCmd	Reset the Relay Outputs, LEDs, Communication, and the Trip Command.	Inactive, Active	Inactive	[Operation /Reset]
Reboot	Rebooting the device.	No, Yes	No	[Service /General]
Maint Mode Manually	Arc Flash Reduction Maintenance Switch Mode: Manual Activation of the Arc Flash Reduction Mode Only available if: Maint Mode = Activation Manually	Maint Mode inactive, Activation via Comm, Activation via DI, Inactive, Active	Inactive	[Service /Maint Mode Manually]

CAUTION **CAUTION, rebooting the device manually will release the Supervision Contact.**

Global Protection Parameters of the System

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
PSet-Switch	Switching Parameter Set	PS1, PS2, PS3, PS4, PSS via Inp fct, PSS via Comm	PSS via Inp fct	[Protection Para /PSet-Switch]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
PS1: Activated by	This Setting Group will be the active one if: The Parameter Setting Group Switch is set to "Switch via Input" and the other three input functions are inactive at the same time. In case there is more than one input function active, no Parameter Setting Group Switch will be executed. In case all input functions are inactive, the device will keep working with the Setting Group that was activated lastly. Only available if: PSet-Switch = PSS via Inp fct	-.-, DI Slot X1.DI 1, DI Slot X1.DI 2, DI Slot X1.DI 3, DI Slot X1.DI 4, DI Slot X1.DI 5, DI Slot X1.DI 6, DI Slot X1.DI 7, DI Slot X1.DI 8, Sys.Maint Mode Active, Sys.Maint Mode Inactive	-.-	[Protection Para /PSet-Switch]
PS2: Activated by	This Setting Group will be the active one if: The Parameter Setting Group Switch is set to "Switch via Input" and the other three input functions are inactive at the same time. In case there is more than one input function active, no Parameter Setting Group Switch will be executed. In case all input functions are inactive, the device will keep working with the Setting Group that was activated lastly. Only available if: PSet-Switch = PSS via Inp fct	-.-, DI Slot X1.DI 1, DI Slot X1.DI 2, DI Slot X1.DI 3, DI Slot X1.DI 4, DI Slot X1.DI 5, DI Slot X1.DI 6, DI Slot X1.DI 7, DI Slot X1.DI 8, Sys.Maint Mode Active, Sys.Maint Mode Inactive	-.-	[Protection Para /PSet-Switch]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
PS3: Activated by	This Setting Group will be the active one if: The Parameter Setting Group Switch is set to "Switch via Input" and the other three input functions are inactive at the same time. In case there is more than one input function active, no Parameter Setting Group Switch will be executed. In case all input functions are inactive, the device will keep working with the Setting Group that was activated lastly. Only available if: PSet-Switch = PSS via Inp fct	-.-, DI Slot X1.DI 1, DI Slot X1.DI 2, DI Slot X1.DI 3, DI Slot X1.DI 4, DI Slot X1.DI 5, DI Slot X1.DI 6, DI Slot X1.DI 7, DI Slot X1.DI 8, Sys.Maint Mode Active, Sys.Maint Mode Inactive	-.-	[Protection Para /PSet-Switch]
PS4: Activated by	This Setting Group will be the active one if: The Parameter Setting Group Switch is set to "Switch via Input" and the other three input functions are inactive at the same time. In case there is more than one input function active, no Parameter Setting Group Switch will be executed. In case all input functions are inactive, the device will keep working with the Setting Group that was activated lastly. Only available if: PSet-Switch = PSS via Inp fct	-.-, DI Slot X1.DI 1, DI Slot X1.DI 2, DI Slot X1.DI 3, DI Slot X1.DI 4, DI Slot X1.DI 5, DI Slot X1.DI 6, DI Slot X1.DI 7, DI Slot X1.DI 8, Sys.Maint Mode Active, Sys.Maint Mode Inactive	-.-	[Protection Para /PSet-Switch]
Ack LED	All acknowledgeable LEDs will be acknowledged if the state of the assigned signal becomes true.	1..n, Assignment List	-.-	[Device Para /Ex Acknowledge]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Ack RO	All acknowledgeable Relay Outputs will be acknowledged if the state of the assigned signal becomes true.	1..n, Assignment List	-.-	[Device Para /Ex Acknowledge]
Ack Comm	Communication will be acknowledged if the state of the assigned signal becomes true.	1..n, Assignment List	-.-	[Device Para /Ex Acknowledge]
Scaling	Display of the measured values as primary, secondary, or per unit values	Per unit values, Primary values, Secondary values	Primary values	[Operation /General Settings]
Maint Mode	Activation Mode of the Arc Flash Reduction. Switching into another mode is only possible when no Activation Signal is active (pending).	Inactive, Activation Manually, Activation via Comm, Activation via DI	Activation via DI	[Service /Maint Mode]
Maint Mode Activated by	Activation Signal for the Arc Flash Reduction Maintenance Switch Only available if: Maint Mode Activated by = Activation via DI	-.-, DI Slot X1.DI 1, DI Slot X1.DI 2, DI Slot X1.DI 3, DI Slot X1.DI 4, DI Slot X1.DI 5, DI Slot X1.DI 6, DI Slot X1.DI 7, DI Slot X1.DI 8	DI Slot X1.DI 7	[Service /Maint Mode]

System Module Input States

Name	*Description*	*Assignment Via*
Ack LED-I	Module Input State: LEDs Acknowledgment by Digital Input.	[Device Para /Ex Acknowledge]
Ack RO-I	Module Input State: Acknowledgment of the Relay Outputs.	[Device Para /Ex Acknowledge]
Ack Comm-I	Module Input State: Acknowledge Communication via Digital Input. The replica that Communication has received from the device is to be reset.	[Device Para /Ex Acknowledge]
PS1-I	State of the module input, respectively of the signal, that should activate this Parameter Setting Group.	[Protection Para /PSet-Switch]
PS2-I	State of the module input, respectively of the signal, that should activate this Parameter Setting Group.	[Protection Para /PSet-Switch]
PS3-I	State of the module input, respectively of the signal, that should activate this Parameter Setting Group.	[Protection Para /PSet-Switch]
PS4-I	State of the module input, respectively of the signal, that should activate this Parameter Setting Group.	[Protection Para /PSet-Switch]
Maint Mode-I	Module Input State: Arc Flash Reduction Maintenance Switch	[Service /Maint Mode]

System Module Signals

Name	*Description*
Reboot	Signal: Rebooting the device: 1=Restart initiated by power supply; 2=Restart initiated by the user; 3=Set on defaults (Super Reset); 4=Restart by the debugger; 5=Restart because of configuration change; 6=General failure; 7=Restart initiated by System Abort (host side); 8=Restart initiated by watchdog timeout (host side); 9=Restart initiated by System Abort (dsp side); 10=Restart initiated by watchdog timeout (dsp side); 11=Power supply failure (short term interruption) or power supply voltage to low; 12=illegal memory access.
Act Set	Signal: Active Parameter Set
PS 1	Signal: Parameter Set 1
PS 2	Signal: Parameter Set 2
PS 3	Signal: Parameter Set 3
PS 4	Signal: Parameter Set 4
PSS manual	Signal: Manual switch over of a Parameter Set
PSS via Comm	Signal: Parameter Set Switch via Communication
PSS via Inp fct	Signal: Parameter Set Switch via Input Function
Min. 1 param changed	Signal: At least one parameter has been changed
Maint Mode Active	Signal: Arc Flash Reduction Maintenance Active
Maint Mode Inactive	Signal: Arc Flash Reduction Maintenance Inactive
Maint Mode Manually	Signal: Arc Flash Reduction Maintenance Manual Mode
Maint Mode Comm	Signal: Arc Flash Reduction Maintenance Comm Mode
Maint Mode DI	Signal: Arc Flash Reduction Maintenance Digital Input Mode
Param to be saved	Number of parameters to be saved. 0 means that all parameter changes are overtaken.
Ack LED	Signal: LEDs Acknowledgment
Ack RO	Signal: Acknowledgment of the Relay Outputs
Ack Counter	Signal: Reset of all Counters
Ack Comm	Signal: Acknowledge Communication
Ack TripCmd	Signal: Reset Trip Command
Ack LED-HMI	Signal: LEDs Acknowledgment :HMI
Ack RO-HMI	Signal: Acknowledgment of the Relay Outputs :HMI
Ack Counter-HMI	Signal: Reset of all Counters :HMI
Ack Comm-HMI	Signal: Acknowledge Communication :HMI
Ack TripCmd-HMI	Signal: Reset Trip Command :HMI
Ack LED-Comm	Signal: LEDs Acknowledgment :Communication
Ack RO-Comm	Signal: Acknowledgment of the Relay Outputs :Communication
Ack Counter-Comm	Signal: Reset of all Counters :Communication
Ack Comm-Comm	Signal: Acknowledge Communication :Communication
Ack TripCmd-Comm	Signal: Reset Trip Command :Communication

Special Values of the System Module

Value	*Description*	*Menu Path*
Build	Build	[Device Para /Version]
Version	Version	[Device Para /Version]
Operating hours Cr	Operating hours counter	[Operation /Count and RevData /Sys]

Commissioning

Before starting work on an open switchboard, it is required that the switchboard is de-energized and the following five safety regulations have been met.

DANGER

Safety precautions:

- **Disconnect the power supply;**
- **Secure against reconnection;**
- **Verify that the equipment is de-energized;**
- **Connect to ground and short-circuit all phases; and**
- **Cover or safeguard all live adjacent parts.**

DANGER

The secondary circuit of a current transformer must never be opened during operation. The prevailing high voltages can cause severe injury or death.

WARNING

Even when the auxiliary voltage is switched off, it is likely that there are still hazardous voltages at the component connections.

All locally applicable national and international installation and safety regulations for working at electrical power installations MUST always to be followed.

WARNING

Prior to the initial voltage connection, the following must be guaranteed:

- **Correct grounding of the device;**
- **That all signal circuits are tested;**
- **That all control circuits are tested;**
- **Transformer wiring is checked;**
- **Correct rating of the CTs;**
- **Correct burden of the CTs;**
- **That the operational conditions are in line with the Technical Data;**
- **Correct rating of the transformer protection;**
- **Function of the transformer fuses;**
- **Correct wiring of all digital inputs;**
- **Polarity and capacity of the supply voltage; and**
- **Correct wiring of the analog inputs and outputs.**

NOTICE

The permissible deviations of measuring values and device adjustment are dependent on the technical data/tolerances.

Commissioning/Protection Test

WARNING **Commissioning/protection test must be carried out by authorized and qualified personnel. Before the device is put into operation, the related documentation MUST be read and understood.**

WARNING **With any test of the protection functions, the following has to be checked:**

- **Is activation/tripping saved in the event recorder?**
- **Is tripping saved in the fault recorder?**
- **Is tripping saved in the disturbance recorder?**
- **Are all signals/messages correctly generated?**
- **Do all generally configured blocking functions work properly?**
- **Do all temporarily configured (via DI) blocking functions work properly?**
- **To enable checks on all LEDs and relay functions, these have to be provided with the relevant pickup (alarm) and tripping functions of the respective protection functions/elements. This MUST be tested in practical operation.**

WARNING **Check of all temporary blockings (via digital inputs).**

- **In order to avoid malfunctions, all blockings related to tripping/non-tripping of protection function MUST be tested. The test can be very complex and should therefore be performed by the same personnel who set up the protection concept.**

CAUTION **Check of all general trip blockings. All general trip blockings MUST be tested.**

NOTICE **Prior to the initial operation of the protection device, all tripping times and values shown in the adjustment list MUST be confirmed by a secondary test.**

NOTICE **Any description of functions, parameters, inputs, or outputs that does not match the device in hand, can be ignored.**

Decommissioning – Removing the Plug from the Relay

WARNING

Dismounting the relay will lead to a loss of the protection functionality. Ensure that there is a back-up protection. If you are not aware of the consequences of decommissioning the device – stop! DO NOT start.

WARNING

Inform SCADA before you start.

Switch-off the power supply.

Ensure that the cabinet is de-energized and that there are no voltages that could lead to injury of personnel.

Disconnect the terminals at the rear-side of the device. DO NOT pull any cable – pull on the plug! If it is stuck, use a screw driver.

Fasten the cables and terminals in the cabinet by means of cable clips to ensure that no accidental electrical connections are caused.

Hold the device at the front-side while removing the mounting nuts.

Remove the device carefully from the cabinet.

In case no other device is to be mounted or replaced, cover/close the cut-out in the front-door.

Close the cabinet.

Service

General

Within the Service menu, the User can initiate a reboot of the device.

Maintenance Mode

Principle – General Use

NOTICE **The Maintenance Mode can be used to reduce arc flash levels. Refer to Std NFPA70E.**

DANGER **DO NOT attempt to install or perform maintenance on equipment while it is energized. Severe personal injury or death can result from contact with energized equipment. Verify that no voltage is present before opening doors of the switchboard.**

DANGER **If maintenance will be performed on a device, special protective clothing and equipment MUST BE USED and all industry standard procedures MUST BE FOLLOWED. Failure to do so can result in severe personal injury or death.**

The Maintenance Mode can improve safety by providing a simple and reliable method to reduce fault clearing time and lower incident energy levels at energized panels. The Maintenance Mode allows the User to switch to more sensitive settings via the HMI/panel, Communication, or via a Digital Input while maintenance work is being performed at an energized panel or device. The more sensitive settings provide greater security for maintenance personnel and helps reduce the possibility of injury.

The status of the Maintenance Mode (active/inactive) is stored power fail safe.

NOTICE **Manual activation is only possible via the HMI/panel (not via PowerPort-E).**

The Maintenance Mode can be activated:

- Manual (only at the HMI/panel);
- Via Communication; or
- Via a Digital Input.

NOTICE **Changing to another mode is only possible if there is no active Activation Signal (e.g.: if the device is in the “Via Digital Input Mode” and while the assigned Digital Input is “true”, the User cannot switch to the “Manual Mode”).**

Before Use

DANGER **The sensitivity settings for the Maintenance Mode have to be calculated and programmed into the device (according to Std NFPA70E). They are not part of the device by default.**

When the Maintenance Mode is enabled and fault current causes its operation, the fault clearing time of the associated breaker has to be very fast. Calculate the sensitivity setting on the basis of **Std NFPA70E.**

Program those sensitivity settings either into a setting group or into Adaptive Parameters.

How to Use the Maintenance Mode

Calculate the sensitivity setting on the basis of **Std NFPA70E.** Program those sensitivity settings either into a setting group or into Adaptive Parameters.

The Maintenance Mode offers two output signals: “Maint Mode activated” and “Maint Mode not activated”.

The »Maint Mode.ACTIVATED« signal should be used to:

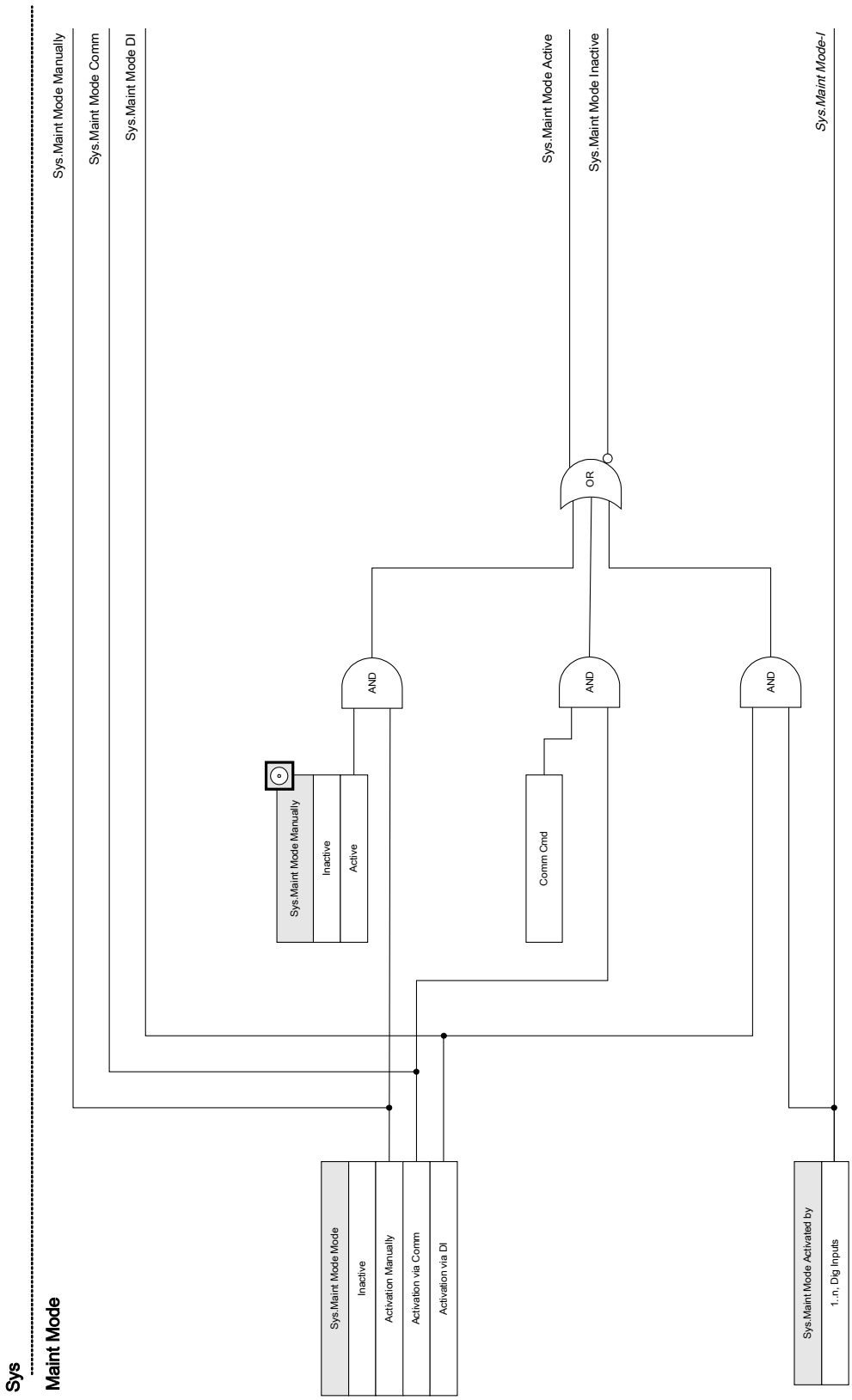
- Switch to another setting group (in case that the sensitivity settings are saved within this setting group);
- Activate “Adaptive Parameters” (in case that the sensitivity settings are saved within these adaptive parameters); and/or
- Block or activate dedicated functions.

Please see the Adaptive Parameters section for more details.

The »Maint Mode.NOT ACTIVATED« signal should be used to:

- Switch back to the standard setting group when Maintenance Mode should not be used.

For a fast access, the Maintenance Mode can be accessed by means of the »Softkey« Maint on the start screen (root) of the device.


Sys
Maint Mode
Sys.Maint Mode Manually
Sys.Maint Mode Comm
Sys.Maint Mode DI
Sys.Maint Mode Active
Sys.Maint Mode Inactive
Sys.Maint Mode-I
OR
AND
AND
AND
Sys.Maint Mode Manually
Inactive
Active
Comm Cmd
Sys.Maint Mode Mode
Inactive
Activation Manually
Activation via Comm
Activation via DI
Sys.Maint Mode Activated by
1..n. Dig Inputs

Forcing the Relay Output Contacts

NOTICE **The parameters, their defaults, and setting ranges have to be taken from Relay Output Contacts section.**

Principle – General Use

DANGER **The User MUST ENSURE that the relay output contacts operate normally after maintenance is completed. If the relay output contacts do not operate normally, the protective device WILL NOT provide protection.**

For commissioning purposes or for maintenance, relay output contacts can be set by force.

Within this mode [Service/Test/Force RO], relay output contacts can be set by force:

- Permanent; or
- Via timeout.

If they are set with a timeout, they will keep their “Force Position” only as long as this timer runs. If the timer expires, the relay will operate normally. If they are set as Permanent, they will keep the “Force Position” continuously.

There are two options available:

- Forcing a single relay »*Force Rox«;* and
- Forcing an entire group of relay output contacts »*Force all Outs«*.

Forcing an entire group takes precedence over forcing a single relay output contact!

NOTICE **A relay output contact <u>will NOT follow a force command</u> as long as it is disarmed at the same time.**

NOTICE **A relay output contact <u>will follow a force command:</u>**

If it is not disarmed; and

If the Direct Command is applied to the relay(s).

Keep in mind, that the forcing of all relay output contacts (of the same assembly group) takes precedence over the force command of a single relay output contact.

Disarming the Relay Output Contacts

NOTICE **The parameters, their defaults, and setting ranges have to be taken from the Relay Output Contacts section.**

Principle – General Use

Within this mode [Service/Test/Disarmed], entire groups of relay output contacts can be disabled. By means of this test mode, contact outputs switching actions of the relay output contacts are prevented. If the relay output contacts are disarmed, maintenance actions can be carried out without the risk of taking entire processes off-line.

DANGER **The User MUST ENSURE that the relay output contacts are ARMED AGAIN after maintenance is complete. If they are not armed, the protective device WILL NOT provide protection.**

NOTICE **Zone Interlocking Output and the Supervision Contact cannot be disarmed.**

Within this mode [Service/Test/DISARMED] entire groups of relay output contacts can be disarmed:

- Permanent; or
- Via timeout.

If they are set with a timeout, they will keep their “Disarm Position” only as long as this timer runs. If the timer expires, the relay output contacts will operate normally. If they are set Permanent, they will keep the “Disarm State” continuously.

NOTICE **A relay output contact <u>will NOT be disarmed as long as</u>:**

A relay output contact will NOT be disarmed if it´s latched (and not yet reset).

A relay output contact will NOT be disarmed as long as a running t-OFF-delay timer is not yet expired (hold time of a relay output contact).

If the Disarm Control is not set to active.

If the Direct Command is not applied.

NOTICE **A relay output contact <u>will be disarmed</u> if it´s not latched and**

If there is no running t-OFF-delay timer (hold time of a relay output contact) and

If the DISARM Control is set to active and

If the Direct Command Disarm is applied.

Self Supervision

The devices are continuously monitored and supervised through different methods during normal operation as well as during the start-up phase.

Results of this supervision may be:

- Messages appearing within the event-recorder;
- Indications within the display or PowerPort-E;
- Corrective measures;
- Disabling of protection functions;
- Restart of the device; or
- Any combination of the above results.

In case of failures that cannot be corrected immediately, 3 restarts within 20 minutes are accepted before the device will be deactivated. In such a case, the device should be removed in for service to ensure continuous correct operation. The Eaton Customer Service contact information and address can be found at the front of this manual.

In case of any failures, the recorders of the device should be left untouched to ensure an easy diagnosis and proper repair at the factory. Besides the records and visible indications to the customer, there is internal information about failures. These allow Eaton service personnel at the repair facility to make a detailed analysis of files with failure reports.

Self supervision is applied by different functions at different cyclic or non-cyclic timings to the following parts and functions of the device:

- Faultless cyclic execution of the software;
- Functional capability of memory boards;
- Consistency of data;
- Functional capability of hardware sub-assemblies; and
- Faultless operation of the measuring unit.

Faultless cyclic operation of the software is supervised by timing analysis and checking results of different functions. Errors of the software function (watchdog function) lead to restarting the device and switching off the self-supervision relay (life contact). In addition, the “System-OK” LED will blink red after 3 unsuccessful attempts to restart the device within a time-period of 20 minutes.

The main processor cyclically monitors the operation of the signal processor and initiates corrective actions or restart of the device in case of faulty operation.

Data and files are generally secured against unintended overwriting or faulty changes by check-sums.

The measuring unit continuously checks the measured data by comparing received data with data from a second channel sampled in parallel.

Monitoring of the auxiliary voltage is done by reset IC's. If the voltage of one of the different supply circuits falls below a certain threshold, a restart of the device is initiated. There are three major supply groups (24 V, 3.3 V and 1.6 V), each of them being monitored separately and forcing the processor to reset (stop of the device) until the voltage again reaches nominal value. If the voltage staggers around the threshold, the device also starts again after five s.

Independent of these separate monitoring functions, the intermediate voltage circuit is buffered for 100 ms until all important and relevant operational and fault-data have been saved and the device initiates a restart. The device will restart after five (5) seconds.

Error Messages / Codes

After a reboot of the device, the reason for rebooting will be displayed under [Operation/Status Display/Sys/Reset]. For more information about the reboot reason, please refer to the information in this section.

The reboot will also be logged within the event recorder. Rebooting causes an event named “Sys.reboot”.

Numeric Reboot Codes

Error Messages / Codes	
1.	Reboot after clean switching off of the device - Normal reboot after clean shut-down of the device.
2.	Reboot by User command - User-initiated reboot through panel command.
3.	Super reset - Reset to factory settings.
4.	Restart by debugger - Eaton internally for system-analysis purposes.
5.	Restart because of configuration changes.
6.	General failure - Reboot without definite reason.
7.	Reboot by “SW-system abort” (HOST-side) - Summary of several reboot reasons detected by the software (i.e.: wrong pointer, corrupted files, etc.).
8.	Reboot by watchdog timeout (HOST-side) - Signaling if the protection-class-task hangs for more than 800 ms.
9.	Reboot by system abort (DSP-side) - Summary of several reboot reasons detected by software (i.e.: wrong pointer, DSP-side).
10.	Reboot by watchdog timeout (DS-side) - Appears when DSP sequence needs longer than 3 ms for one cycle.
11.	Loss of auxiliary voltage or low voltage reboot after loss of auxiliary voltage or voltage dropping below reboot level but not becoming zero.
12.	Faulty memory access - Message of MMU (memory mapping unit) that prohibited memory access has occurred.

Technical Data

NOTICE **Use Copper conductors only, 75°C (167°F).**
Conductor size AWG 14 [2.5 mm].

Climatic Environmental Conditions

Storage Temperature:	-30°C to +70°C (-22°F to 158°F)
Operating Temperature:	-20°C to +60°C (-4°F to 140°F)
Permissible Humidity at Ann. Average:	<75% rel. (on 56d up to 95% rel.)
Permissible Installation Altitude:	<2,000 m (6,562 ft) above sea level If 4,000 m (13,123 ft) altitude applies, a changed classification of the operating and test voltages may be necessary.

Degree of Protection EN 60529

HMI Front Panel with Seal:	IP54
Rear Side Terminals:	IP20

Routine Test

Insulation Test Acc. to IEC60255-5:	All tests to be carried out against ground and other input and output circuits.
Aux. Voltage Supply, Digital Inputs, Current Measuring Inputs, Signal Relay Outputs:	2.5 kV (eff.) / 50 Hz
Voltage Measuring Inputs:	3.0 kV (eff.) / 50 Hz
All Wire-Bound Communication Interfaces:	1.5 kV DC

Housing

Housing B2: Height/Width	6.881 in. (173 mm) / 4 U / 8.374 in. (212.7 mm) / 42 HP
Housing Depth (Incl. Terminals):	8.189 in. (208 mm)
Material, Housing:	Aluminum extruded section
Material, Front Panel:	Aluminium/Foil front
Mounting Position:	Horizontal (±45° around the X-axis must be permitted)
Weight:	ETR-4000 housing B2: approx. 9.259 lb (4.2 kg)

Plug-in Connector with Integrated Short-Circuiter (Conventional Current Inputs)

Nominal Current:	1 A and 5 A
Continuous Loading Capacity:	4 x In / continuously
Overcurrent Withstand:	30 x In / 10 s 100 x In / 1 s 250 x In / 10 ms (1 half-wave)
Screws:	M4, captive type acc. to VDEW
Connection Cross Sections:	2 x AWG 14 (1 x or 2 x 2.5 mm²) with wire end ferrule 2 x AWG 12 (1 x or 2 x 4.0 mm²) with ring cable sleeve or cable sleeve 2 x AWG 10 (1 x or 2 x 6 mm²) with ring cable sleeve or cable sleeve The current measuring board´s terminal blocks may be used as with 2 (double) conductors AWG 10,12,14 otherwise with single conductors only.

Voltage Supply

Aux. Voltage:	24 - 270 Vdc / 48 - 230 Vac (-20/+10%)
Buffer Time in Case of Supply Failure:	>= 50 ms at minimal aux. voltage Interrupted communication is permitted.
Max. Permissible Making Current:	18 A peak value for <0.25 ms 12 A peak value for <1 ms

The voltage supply must be protected by a fuse of:

- 2,5 A time-lag miniature fuse approx. 1/5 x 0.8 in. (5 x 20 mm) according to IEC 60127, and
- 3,5 A time-lag miniature fuse approx. 1/4 x 1 ¼ in. (6,3 x 32 mm) according to UL 248-14.

Power Consumption

Power Supply Range:	Power Consumption in Idle Mode	Max. Power Consumption
19-300 Vdc:	7 W	13 W
40-250 Vac (For Frequencies of 40-70 Hz):	7 W	13 W

Real Time Clock

Running Reserve of the Real Time Clock:	1 year min.

Display

Display Type:	LCD with LED background illumination
Resolution - Graphics Display:	128 x 64 pixel
LED - Type:	Two colored: red / green
Number of LEDs, Housing B2:	15

Digital Inputs

Max. Input Voltage:	300 Vdc / 270 Vac
Input Current:	<4 mA
Reaction Time:	<20 ms
Fallback Time:	<30 ms

(Safe State of the Digital Inputs)

4 Switching Thresholds:	Un = 24 Vdc, 48 Vdc, 60 Vdc, 110 Vac / dc, 230 Vac / dc
Un = 24 Vdc	
Switching Threshold 1 ON:	Min. 19.2 Vdc
Switching Threshold 1 OFF:	Max. 9.6 Vdc
Un = 48 V / 60Vdc	
Switching Threshold 2 ON:	Min. 42.6 Vdc
Switching Threshold 2 OFF:	Max. 21.3 Vdc
Un = 110 / 120 Vac / dc	
Switching Threshold 3 ON:	Min. 88.0 Vdc / 88.0 Vac
Switching Threshold 3 OFF:	Max. 44.0 Vdc / 44.0 Vac
Un = 230 / 240 Vac / dc	
Switching Threshold 4 ON:	Min. 184 Vdc / 184 Vac
Switching Threshold 4 OFF:	Max. 92 Vdc / 92 Vac
Terminals:	Screw-type terminal

Current and Ground Current Measurement

Nominal Currents:	1 A / 5 A
Max. Measuring Range:	Up to 40 x In (phase currents) Up to 25 x In (ground current standard) Up to 2.5 x In (ground current sensitive)
Continuous Loading Capacity:	4 x In / continuously
Overcurrent Proof:	30 x In / 10 s 100 x In / 1 s 250 x In / 10 ms (1 half-wave)
Power Consumption:	Phase current inputs At In = 1 A S = 0.15 mVA At In = 5 A S = 0.15 mVA Ground current input At In = 1 A S = 0.35 mVA At In = 5 A S = 0.35 mVA
Frequency Range:	50 Hz / 60 Hz ±10%
Terminals:	Screw-type terminals with integrated short-circuiters (contacts)
Connection Cross Sections:	1 x or 2 x 2.5 mm² (2 x AWG 14) with wire end ferrule 1 x or 2 x 4.0 mm² (2 x AWG 12) with ring cable sleeve or cable sleeve 1 x or 2 x 6 mm² (2 x AWG 10) with ring cable sleeve or cable sleeve The current measuring board´s terminal blocks may be used as with 2 (double) conductors AWG 10,12,14 otherwise with single conductors only.

Relay Outputs

Continuous Current:	5 A ac / dc
Max. Make Current:	25 A ac / 25 A dc up to 30 V for 4 s 30 A / 230 Vac according to ANSI IEEE Std C37.90-2005 30 A / 250 Vdc according to ANSI IEEE Std C37.90-2005
Max. Breaking Current:	5 A ac up to 125 Vac 5 A dc up to 30 V (resistive) 0.3 A dc at 300 V
Max. Switching Voltage:	250 Vac / 250 Vdc
Switching Capacity:	1,250 VA
Contact Type:	Form C or normally open contact
Terminals:	Screw-type terminals

Supervision Contact (SC)

Continuous Current:	5 A at 120/240 Vac or 30 Vdc
Max. Switch-on Current:	15 A at 120/240 Vac or 30 Vdc (max. 4s)
Max. Breaking Current:	5 A at 120/240 Vac or 30 Vdc 0,4 A at 125 Vdc
Contact Type:	1 Form C contact
Terminals:	Screw-type terminals

Time Synchronization IRIG

Nominal Input Voltage:	5 V
Connection:	Screw-type terminals (twisted pair)

Front Interface RS232

Baud Rates:	115,200 Baud
Handshake:	RTS and CTS
Connection:	9-pole D-Sub plug

RS485

Master/Slave:	Slave
Connection:	6 screw-clamping terminals RM 138 MIL (3.5 mm) (terminating resistors internal)

CAUTION

The RS485 interface is realized via terminals. The communication cable has to be shielded. The shielding has to be fixed at the screw that is marked with the ground symbol (rear side of the device).

Zone Interlocking

NOTICE

Only for Zone Interlock Tripping Outputs (Zone Interlock, semiconductor output): 5 Vdc, <2mA for connection to electronic inputs only.

Zone Out:	
Output voltage (High)	4.75 to 5.25 Vdc
Output voltage (Low)	0.0 to +0.5 Vdc
Zone In:	
Nominal input voltage	+5 Vdc
Max. input voltage	+5.5 Vdc
Switching threshold ON	min. 4.0 Vdc
Switching threshold OFF	max. 1.5 Vdc
Galvanic isolation	2.5 kV ac (to ground and other IO)
Connection:	Screw-type terminals (twisted pair)

Boot Phase

After switching on the power supply, the protection will be available in approximately 46 seconds. After approximately 97 seconds, the boot phase is completed (HMI and Communication initialized).

Standards

Approvals

- UL-listed file: e217753

Design Standards

Generic Standard	EN 61000-6-2 EN 61000-6-3
Product Standard	IEC 60255-6 EN 50178 UL 508 (Industrial Control Equipment) CSA C22.2 No. 14-95 (Industrial Control Equipment) ANSI C37.90

High Voltage Tests (IEC 60255-6)

High Frequency Interference Test		
IEC 60255-22-1 Class 3	Within one circuit	1 kV/2 s
	Circuit to ground	2.5 kV/2 s
	Circuit to circuit	2.5 kV/2 s
Insulation Voltage Test		
IEC 60255-5 EN 50178	All circuits to other circuits and exposed conductive parts	2.5 kV (eff.)/50Hz, 1 min.
	Except interfaces	1.5 kV DC, 1 min.
	Voltage measuring input	3 kV (eff.)/50 Hz, 1 min.
Impulse Voltage Test		
IEC 60255-5		5 kV/0.5J, 1.2/50 µs

EMC Immunity Tests

Fast Transient Disturbance Immunity Test (Burst)

IEC 60255-22-4 IEC 61000-4-4 Class 4 ANSI C37.90.1	Power supply, mains inputs	±4 kV, 2.5 kHz
	Other in- and outputs	±2 kV, 5 kHz (coupling network) ±4 kV, 2.5 kHz (coupling clamp)

Surge Immunity Test

IEC 61000-4-5 Class 4	Within one circuit	2 kV
	Circuit to ground	4 kV

Electrical Discharge Immunity Test

IEC 60255-22-2 IEC 61000-4-2 Class 3	Air discharge	8 kV
	Contact discharge	6 kV

Radiated Radio Frequency Electromagnetic Field Immunity Test

IEC 61000-4-3 Class X ANSI C37.90.2	26 MHz – 80 MHz	10 V/m
	80 MHz – 1 GHz	35 V/m
	1 GHz – 3 GHz	10 V/m

Immunity to Conducted Disturbances Induced by Radio Frequency Fields

IEC 61000-4-6 Class 3		10 V

Power Frequency Magnetic Field Immunity Test

IEC 61000-4-8 Class 4	Continuous	30 A/m
	3 sec	300 A/m

EMC Emission Tests

Radio Interference Suppression Test

IEC/CISPR11		Limit value class B

Radio Interference Radiation Test

IEC/CISPR11		Limit value class B

Environmental Tests

Classification:		
IEC 60068-1	Climatic	0/055/56
	Classification	
IEC 60721-3-1	Classification of ambient conditions (Storage)	1K5/1B1/1C1L/1S1/1M2 but min. -25°C (-13°F)
IEC 60721-3-2	Classification of ambient conditions (Transportation)	2K3/2B1/2C1/2S1/2M2
IEC 60721-3-3	Classification of ambient conditions (Stationary use at weather protected locations)	3K6/3B1/3C1/3S1/3M2 but min. 0°C (32°F) and 3K8H for 2 h
Test Ad: Cold		
IEC 60068-2-1	Temperature	-20°C (-4°F)
	Test duration	16 h
Test Bd: Dry Heat		
IEC 60068-2-2	Temperature	55°C (131°F)
	Relative humidity	<50%
	Test duration	72 h
Test Cab: Damp Heat (Steady State)		
IEC 60068-2-78	Temperature	40°C (104°F)
	Relative humidity	93%
	Test duration	56 d
Test Db: Damp Heat (Cyclic)		
IEC 60068-2-30	Temperature	55°C (131°F)
	Relative humidity	95%
	Cycles (12 + 12-hour)	2

Mechanical Tests

Test Fc: Vibration Response Test		
IEC 60068-2-6 IEC 60255-21-1 Class 1	(10 Hz – 59 Hz) Displacement	0.0014 in. (0.035 mm)
	(59Hz – 150Hz) Acceleration	0.5 gn
	Number of cycles in each axis	1
Test Fc: Vibration Endurance Test		
IEC 60068-2-6 IEC 60255-21-1 Class 1	(10 Hz – 150 Hz) Acceleration	1.0 gn
	Number of cycles in each axis	20
Test Ea: Shock Test		
IEC 60068-2-27 IEC 60255-21-2 Class 1	Shock response test	5 gn, 11 ms, 3 impulses in each direction
	Shock resistance test	15 gn, 11 ms, 3 impulses in each direction
Test Eb: Shock Endurance Test		
IEC 60068-2-29 IEC 60255-21-2 Class 1	Shock endurance test	10 gn, 16 ms, 1,000 impulses in each direction
Test Fe: Earthquake Test		
IEC 60068-3-3 KTA 3503 IEC 60255-21-3 Class 2	Single axis earthquake vibration test	3 – 7 Hz: Horizontal 0.394 in. (10 mm), 1 cycle each axis 7 – 35 Hz Horizontal: 2 gn, 1 cycle each axis

Tolerances

Tolerances of the Real Time Clock

Resolution:	1 ms
Tolerance:	<1 minute / month (+20°C [68°F]) <±1 ms if synchronized via IRIG-B

Tolerances of the Measured Value Acquisition

Phase and Ground Current Measuring

Max. Measuring Range:	Up to 40 x In (phase currents) Up to 25 x In (ground current standard) up to 2.5 x In (Earth current sensitive)
Please Note:	The precision does not depend on the nominal value but is referenced to 100 mA (with In =1 A) respectively. 500 mA (with In = 5 A)
Frequency Range:	50 Hz / 60 Hz ± 10%
Accuracy:	Class 0.5
Amplitude Error if I < 1 In:	±0.5% of the rated value
Amplitude Error if I > In:	±0.5% of the measured value
Amplitude Error if I > 2 In:	±1.0% of the measured value
Resolution:	0.01 A
Harmonics:	Up to 20% 3rd harmonic ±1% Up to 20% 5th harmonic ±1%
Frequency Influence:	<±2% / Hz in the range of ±5 Hz of the configured nominal frequency
Temperature Influence:	<±1% within the range of 0°C to +60°C (+32°F to +140°F)

Protection Elements Tolerances

NOTICE

The tripping delay relates to the time between alarm and trip. The tolerance of the operating time relates to the time between when the measured value has exceeded the threshold until the protection element is Picked-up.

Differential Protection Stages: 87[x]	*Tolerance*
Id > 0.1 Id[x]	±3% of the setting value resp. 1% In.
Operating time	
Id > 0.3 x In	< 35 ms
Id > 0.5 x In	< 25 ms
Id > 1.5 x In	< 20 ms

Earth Differential Protection Stages: 87N[x]	*Tolerance*
Id > 0.1 Id[x]	±3% of the setting value resp. 1% In.
Operating time	
Ide > 0.3 x In	< 35 ms
Ide > 0.5 x In	< 25 ms
Ide > 1.5 x In	< 20 ms

Overcurrent Protection Elements: 50P[x], 51P[x]	Tolerance
Pickup	±1.5% of the setting value resp. 1% In.
Resetting Ratio	97% or 0.5% x In
t	DEFT ±1% resp. ±10 ms
Operating Time Starting from I higher than 1.1 x I>	<+35 ms
Disengaging Time	<+45 ms
t-Multiplier	±5% IEC NINV IEC VINV IEC EINV IEC LINV ANSI MINV ANSI VINV ANSI EINV Flat It I^2t I^4t
Reset Mode	±1% resp. ±10 ms IEC NINV IEC VINV IEC EINV IEC LINV
	5% ANSI MINV ANSI VINV ANSI EINV Flat It I2t I4t

Ground Current Elements: 50G[x], 50N[x], 51G[x], 51N[x]	Tolerance
Pickup	±1.5% of the setting value Resp. 1% In
Resetting Ratio	97% or 0.5% x In
t	DEFT ±1% resp. ±10 ms
Operating Time Starting from IE Higher than 1.1 x IE>	<+35 ms
Disengaging Time	<+45 ms
t-Multiplier	±5% IEC NINV IEC VINV IEC EINV IEC LINV ANSI MINV ANSI VINV ANSI EINV Flat It I^2t I^4t
Reset Mode	±1% resp. ±10 ms IEC characteristics IEC NINV IEC VINV IEC EINV IEC LINV
	5% Reset curves if ANSI characteristics ANSI MINV ANSI VINV ANSI EINV Flat It I^2t I^4t

Thermal Replica: ThR	*Tolerance*
Ib	±2% of the setting value Resp. 1% In
K	
Pickup ThR	±1.5 % of the setting value

Unbalanced Load :51Q[x]	*Tolerance*
I2>	±2% of the setting value resp.1% In
Resetting Ratio	97% or 0.5% x In
t Tripping Delay Time (DEFT)	DEFT ±1% resp. ±10 ms
Operating Time Starting from I2 Higher than 1.3 x I2>	<+60ms
Release Time	<+40ms
k	±5% INV
τ-cool	±5% INV

Inrush Supervision IH2	*Tolerance*
IH2/In	±1% In
Resetting Ratio	1% x In or 5% x IH2

Inrush supervision is possible, if the fundamental Harmonic > 0.1 x In and 2nd Harmonic > 0.01 x In.

Breaker Failure Protection 50BF	*Tolerance*
I-BF>	±1.5% of the setting value resp.1% In
Resetting Ratio	
t-BF	±1% resp. ±10 ms
Operating Time Starting from I Higher than 1.3 x I-BF>	<+40ms
Disengaging Time	<+40 ms

Trip Circuit Monitoring TCM	*Tolerance*
t-TCM	±1% resp. ±10 ms

Current Transformer Supervision CTS	*Tolerance*
ΔI	±2% of the setting value resp. 1.5% In
Resetting Ratio	94%
t	±1% resp. ± 10 ms

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